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ABSTRACT

This document reports on a workshop conducted to bring together vocational, technical, and adult education colleges and the University of Wisconsin-Stout staff members who are working with computer-integrated manufacturing (CIM). Participants discussed current program content, identified areas that need further development, and determined how these programs can be articulated. They also worked on articulation with high schools in the area. Following a brief summary of the workshop, the document contains outlines, agendas, handouts, participant lists, a CIM strategic plan, slide script about CIM at John Deere, summaries of CIM project development at seven Wisconsin technical colleges and the University of Wisconsin-Stout, a paper titled "Articulation: The Key to Educational Transition for Students" (J. Timothy Mero), handouts from a presentation on the future of CIM, and workshop evaluation results. (KC)

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Final Report

June, 1990

VTAE CIM Conference

**A Project Conducted for the
Wisconsin Board of Vocational, Technical and
Adult Education**

**Center for Vocational, Technical and
Adult Education
University of Wisconsin-Stout
Menomonie, WI 54751**

Howard D. Lee

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**VTAE CIM CONFERENCE
June 6 & 7, 1990**

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Project # 30-109-150-310

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Introduction

Wisconsin companies are increasingly competing in a world market place. They are competing for customers who want quality products and services that are designed to meet their specific needs and sold at competitive prices. In this consumer driven, international market place, it is important that a company be able to respond quickly to consumer needs and produce a high quality product. As a result, many of our production, marketing, and management systems are outdated. For example, it is no longer practical to have a two to three year lead time in the development of a new product when a competitor can develop a new model in less than a year.

These conditions are motivating Wisconsin companies to automate more production processes and develop computer controlled manufacturing systems. Computer Integrated Manufacturing (CIM) is a system that integrates the data bases for the marketing, design, production, and operations portions of the company to develop a more efficient and responsive production system. The Wisconsin VTAE system has recognized the importance of CIM. Several VTAE districts are developing programs and facilities based on CIM. CVTAE contacts with these districts through the VTAE Professional Development Coordinator Project has revealed an interest in a meeting where the districts could share their programs and discuss the differences. These districts would also like to have additional input on CIM trends and other new manufacturing techniques. In addition, some high schools are initiating programs in the CIM area. They are purchasing equipment and developing curriculum materials. There is a need to articulate high school programs with the secondary technical college programs. Moreover, there is also a need and opportunity to articulate the two year postsecondary programs with four year university programs.

Purpose

The purpose of this project is to bring together the postsecondary VTAE technical colleges and UW-Stout staff members who are working with CIM to discuss current program content, identify areas that need further development, and determine how these programs can be articulated. In addition, this project will involve a sample of high schools that are working on the CIM related programs in order to identify areas of articulation between the high school and postsecondary programs.

Objectives

This project addressed the following objectives:

1. Identify the latest trends in computer integrated manufacturing (CIM) technology.
2. Identify the common components of the CIM programs being offered in the Wisconsin VTAE System.
3. Specify articulation linkages between two year technical college CIM programs and four year university programs.

4. Determine logical components for high school technology education programs related to CIM.
5. Identify articulation linkages between secondary and postsecondary CIM programs and business and industry.
6. Describe areas in which further curriculum development is needed.

Participants

Participants for the workshop came from three groups. The first group consisted of eight VTAEs who had either a CIM program course center or cell. A contact person in these eight schools was identified by Jean Burns, Trade and Industry Consultant, Wisconsin State Board of Vocational, Technical and Adult Education (see correspondence from Jean Burns in Attachment C). These eight schools were invited to attend and provide information about their CIM program course center or cell. This group was asked to also prepare a 15 minute video tape of their CIM set-up as part of their 25 minute presentation allotment. Each of these schools were also provided \$250 stipend to make the video tape. A letter (see Attachment B for example of correspondence) was sent directly to the identified person with copies sent to the assistant director of instructional service.

A second group of participants consisted of the remaining eight school districts. Each was asked to send two persons to the workshop. A letter was sent to each assistant director who was asked to forward it to the appropriate person(s).

The third group of participants consisted to high school teachers. Because the workshop was also concerned with articulation between VTAE districts and high school, a high school was invited for each VTAE district which had a CIM program. Names of high school instructors were solicited from Dick Kitzmann, Technology Education Consultant, DPI. Other high schools involved in the High Technology Training Project were also invited.

Letters and follow-up phone calls were made to each VTAE District. The final list of participants may be found in Attachment A.

The Workshop

A two day agenda was developed and followed (see Attachment A). Jean Burns was consulted during the development of the agenda to ensure consistency with State Board goals. The overview by industry and the sharing of existing VTAE programs with the future of CIM rounded out the first day. The topics for the second day highlighted issues felt to be important for all participants.

Don Manor, Executive Consultant, John Deere Tech Services started off the conference by presenting "CIM-An Industrial Application." The presentation highlighted a brief history, the need for the John Deere company to change, how the company changed, the kinds of new operations brought in, how they were developed and managed, and the status of the company at the present time. A slide series (see Attachment D for slide script) showed the latest CIM equipment and emphasized the importance of planning. A question and answer

period followed. A 4.69 mean score out of a possible 5 indicates that participants felt the presentation was excellent.

Each of the Technical Colleges present then showed their video tape and explained their CIM program course center or cell. Some provided handouts (see Attachment E) and indicated participants could make copies of the video. Many questions resulted from these presentations. Since most did not know the extent of what is happening at other colleges this session was felt to be very useful. A pooled mean score of 4.2 shows that participants felt these presentations were between above average to excellent.

Don Manor was also asked to share any comments from an industrial perspective as to the present technical college CIM programs.

Frank Zenobia, of Frank Zenobia and Associates, made a one hour and forty five minutes presentation on CIM Concepts and the Future of CIM. See Attachment F for handouts. While the high school teachers found the presentation very technical, the technical college participants found the presentation very stimulating. An evaluation score of 4.6 indicates that participants in general felt the presentation was on the excellent side.

On the morning of day two of the workshop, participants were divided into five groups, (see Attachment G for all group assignments and discussion questions) three technical college groups and two high school groups. They were also mixed up between groups since some technical colleges and high schools sent more than one person. The task of the small group was to determine the CIM components needed, CIM competencies of future workers and to identify Articulation Linkages (existing and needed). After a lively discussion, each group reported their findings to the conference. The groups, participants, and the comments they presented are listed below.

Small Group #1 Morning Worksheet Results

Group Participants: Marv Franson, Virgil Noordyk, Gene Koshak, Terry Tower, Larry Haller, David Stinnett, Ken Mills

Group Leader: Marv Franson

1. CIM Components

- Human Resources-Most Important
- Quality-TAI
- Team Building
- Committed Employees
- F.T. Students in All Programs Need
- Individual Program Skills
- CIM in and of Itself Needs Not to Have Hardware-Minor Importance

2. CIM Competencies

Entry Competencies

- Math/Communications
- Individual Program Competencies

Exit Competencies

- Program Specific Skills
- How Human Factors Integrate into the Organization
- Human Factors-Team Work

3. What Articulation Linkages are Needed

A. With Other Schools/Districts

- Colleges need to work together to select vendors, identify pitfalls, service, software, hardware, training
- Cooperative ventures; three systems-actual, cost, training
- State CIM Steering Committee
- State Board Leadership - Void with J.B. Departure
- We need to help high school teachers recruit students to their programs-stress implications of math, science engineering, orientation to careers

B. Business and Industry

- Companies we work with lead credibility to our programs
- Business and industry reps help recruitment
- Help improve image of colleges

**Small Group #2
Morning Worksheet Results**

Group Participants: Merlin Gentz, Jon Stevenson, Jim Tucker, Ed Falck, Chuck Oestreich, Walt Peters, Mark Durkee

Group Leader: Merlin Gentz

1. CIM Components

Definition: Any factor related to breaking down barriers in communication in an organization.

- Team Building
- Group Dynamics
- Ego Busting
- Understanding the Communication Cycle
- Organizational Structure
- Breaking Down Interdivisional Barriers
- Need for Understanding of the Total Business Operation

Definition: Factors Related to Improving What is Presently Being Done.

- Understanding of the Purpose of the Organization
- Evaluation of Where You Are
- Planning
- Goal Setting
- Process Improvement
- Specific Job Training
- Set Up Reduction
- J.I.T.
- Hardware/Software

2. CIM Competencies

- Problem Solving
- Critical Thinking
- Practical View
- Leadership/Fellowship Qualities
- Communication Skills
- Knowledge of Where to Start
- Evolutionary Vision
- Understanding the "Big" Picture

3. What Articulation Linkages are Needed

A. With Other Schools/Districts

- Real Cooperation

B. Business and Industry

**Small Group #3
Morning Worksheet Results**

Group Participants: Ed Falck, Kevin Lipsky, Robert Housner, John Ross, Steven Skowronski, Al Hiles, Bill Bulloch

Group Leader: Ed Falck

1. CIM Components

Computers

- Professional Growth Technology Outstripping Knowledge Base
- Professional Growth Software Not Keeping up With the Need

Technology

- Common Data Base
- EDI
- Commonality of Equipment to Fit Within Matrix

Integration

- Planning, Protocol and Handshaking, Human Factors
- Communications Between People
- Protocol, Handshaking, Common Topology
- Islands of Automation - Linkage
- Drives Plan, Drives Equipment to Match Human Factors

Manufacturing

- Process Raw Materials, Products, Services
- Look at it as a Business
- Methodologies From Beginning to End
- Environmental Concerns, Waste
- Manage Technological Change

Human

- Politics
- Business Strategy-Business Plan
- Information Strategy-Manage Data
- Manufacturing Strategy-How to Reduce Waste, How to Manufacture Efficiently

2. CIM Competencies

- What are the root causes of problems?
- Architecture of what it takes to run your business? Chart it!
- Understand Process - Lift root and look down on your organization as people!
- There are role models out there - Look for them!
- Job Satisfaction
- Team Involvement, etc.
- Networking
- State has to be a leader and facilitator

**Small Group #4
Morning Worksheet Results**

Group Participants: Fred Skebba, David North, Gordon Haag, Marcel Mildbrandt, Al Miller, Dennis Leonard

Group Leader: Fred Skebba

1. CIM Components

- State Problem - Choose Product
- Planning Functions
- Design (CAD)
- Manufacturing Processes
- Hardware
- Team Work
- Integrate Disciplines

2. CIM Competencies

- Working Together
- Developing Pride and Appreciation for Quality
- Know Concepts of Running an Enterprise
- Computer Literacy
- Know CIM Components
- Basic Skills:
 - Math
 - Communications, etc.

**Small Group #5
Morning Worksheet Results**

Group Participants: Gary Leonard, Mike W. Bird, Steve Prah, Dave Peterson, Al Pitts, Robert Zuleger, Ray Price

Group Leader: Gary Leonard

1. CIM Components

- Basic Skills
- Applications
- CIM Awareness
- Hardware
- Software
- Merging Technologies
- Recommended Core Courses
- Team Teaching

2. CIM Competencies-Knowledge of:

- Business Management
- Material Processes
- Marketing & Distribution
- Engineering & Research
- Manufacturing Production
- Accessing Information

3. What Articulation Linkages are Needed:

A. What Other Schools/Districts

- Shared Resources
- Shared Equipment
- Shared Staff
- Team Teaching
- 2 + 2
- Articulated Competencies
- Common Needs Assessment
- Curriculum Development
- Distance Learning
- Staff Development
- Advisory Committee
- Mentoring
- Communication

B. Business and Industry

- Shared Resources
- Shared Equipment
- Work Place Competencies
- Curriculum Development
- Internship/Job Sharing
- Advisory Committee
- Mentoring
- Field Trips

The commonality of CIM components, competencies and existing and future articulation became apparent. One of the groups decided to define each item which established the parameters for their discussion and reporting. Frank Zenobia and Bob Meyer were asked to comment as each group completed their report and answered questions from the rest of the participants. A mean score of 4.28 shows that the participants felt this session was between above average to excellent.

The afternoon session dealt with CIM mission/position statement, curriculum needs and the future direction of CIM. The participants were redivided into five groups mixing the VTAE and high school. Each group spent one and one half hour in discussion and then reported to the conference. Their summary comments by group follows.

**Small Group #1
Afternoon Worksheet Results**

Group Participants: Dennis Leonard, Gene Koshak, Fred Skebba, Mark Durkee,
John Ross, Bob Zuleger, Jon Stevenson

Group Leader: John Ross

**1. CIM Mission/Position Statement
Secondary**

- Team work-cross boundaries
- Concerns-latitude/release time
- Awareness
- Learning about enterprise
- Junior achievement
- Articulation with postsecondary
- Professional growth activities for faculty
- Networking
- Promote change
- Remove barriers between program areas
- Educate the public about CIM concepts
- Encourage involvement of multiple advisory committees
- Networking-internally/externally
- Deliver to business industry
- Articulate CIM to secondary environment
- Help organizations integrate activities
- Involve professional organizations to support CIM efforts
- Actively pursue industry
- Support for CIM educational efforts
- Promote image change

2. Curriculum Needs

- Good video on the concepts of CIM
- Networking
- CAD/CAM/CNC
- PC technology
- Innmass concepts
- Curriculum time
- Integration of all concepts
- How to set up teaching of CIM concepts
- Access to common data base of curriculum
- Develop network of resources/people
- Interfacing equipment

3. Future Direction of CIM for Wisconsin

- Network between all involved
- Integrate our strengths

**Small Group #2
Afternoon Worksheet Results**

Group Participants: Al Pitts, Terry Tower, Jim Tucker, Robert Housner, David North, Gary Leonard, Ray Price

Group Leader: Al Pitts

1. CIM Mission/Position Statement

Educate students in the concepts of the integration of computer and human resources for all elements of business and industry.

2. Curriculum Needs

The CIM enterprise addresses the exchange of data within an organization. As educators we propose to use CIM to improve our delivery of education and training.

We also propose that all students graduating from Wisconsin schools have a fundamental understanding of CIM and can apply CIM concepts in the world of work.

3. Future Direction of CIM for Wisconsin

**Small Group #3
Afternoon Worksheet Results**

Group Participants: Ken Mills, Larry Haller, Ed Falck, Steven Skowronski, Gordon Haag, Mike W. Bird

Group Leader: Ken Mills

1. CIM Mission/Position Statement

- Include a statewide leadership initiation.
- Process of involvement.
- Structure to provide the linkage between the schools (Include communication).
- Need for industrial support
- Level of commitment
- Vertical articulation
- Emphasis on human elements
- Curriculum structure

2. Curriculum Needs

- Process/system for identifying and sharing curriculum need.
- Dollars with a resource plan.
- Ongoing staff development with a requirement for technical college staff to train secondary staff.
- Technical college staff should make themselves available to secondary board and administration to present information on CIM.

3. Future Direction of CIM for Wisconsin.

- Complete mission statement
- Steering committee (report to state VTAE/DPI)
- Define CIM and set plan for the future
- Industrial group - statewide should be advisor to state technical steering committee.
- Involved school/college needs to make commitment.
- High school technical preparation curricula to help guide students to tech colleges.
- CIM can be taught at secondary school on small project team - costly equipment is not needed.
- Help technical colleges develop CIM.
- CIM will change in the future - need to plan for ongoing change.
- Technical colleges and universities need to be tied into serving industry.

**Small Group #4
Afternoon Worksheet Results**

Group Participants: Merlin Gentz, David Stinnett, Chuck Oestreich, Al Hines, Marcel Mildbrandt, Steve Prah

Group Leader: Merlin Gentz

**1. CIM Mission/Position Statement
High School**

- Awareness to CIM strategies. The concept must be presented to students. Point the big picture.

Technical College

- Integrate the CIM strategies across the business and technical curriculums.
- Graduates are the change agents in business and industry.
- Prepare the technicians who install and service.

College

- Graduates provide the leaders to implement CIM. Understand the theory and process.

2. Curriculum Needs

- Common objectives and goals need to be established. Define terms.
- Instructors need to have opportunity to meet and identify competencies and determine when they should be addressed or taught.
- Dual credit and transfer credit arrangements and agreements need to be established. 2+2+2 arrangements should be developed, implemented and evaluated.

3. Future Direction of CIM for Wisconsin

- Develop additional experiences for managers and faculty members to jointly meet to develop a state plan which stretches across secondary and postsecondary education.
- Establish a state task force to develop the state plan for education in CIM.
- Professional development opportunities must be provided for managers and faculty alike.
- Look for alternative sources of funding.
- Sharing - at a much higher level. (Equipment, facilities, staff, etc.)

**Small Group #5
Afternoon Worksheet Results**

Group Participants: Virgil Noordyk, Walt Peters, Kevin Lipsky, Bill Bulloch, Al Miller, Dave Peterson

Group Leader: Virgil Noordyk

**1. CIM Mission/Position Statement
Secondary Mission**

To develop within the student an awareness of the computer integrated enterprise to assist them in making decisions concerning career choice.

Technical College

To develop within the student an understanding of how their occupational specialty impacts the computer integrated enterprise. To transfer computer integrated manufacturing technology to business and industry.

2. Curriculum Needs

- Technology Education
- Relate Transportation
 - Communication to CIE
 - Construction
 - Manufacturing
- Common curriculum data base
- Staff upgrading

3. Future Direction of CIM for Wisconsin

Total implementation of CIM is essential if Wisconsin's business and industry is to remain competitive in the global market.

The afternoon session concluded with Jim Urness addressing the conference and discussing the need to deal with Computer Integrated Manufacturing across the state. Many questions were asked about a follow-up to this conference. Jim concluded by stating that this conference was a good start to address the CIM needs across the state. Future direction might be through a task force or advisory committee.

Each participant was awarded a Certificate of Completion and asked to complete an evaluation form (see Attachment H).

Credit was applied for at UW-Stout and arranged through the Industrial Marketing Department. Participants could sign up for credit by paying the segregated fee of \$10.40 for graduate and \$13.28 for undergraduate. Twenty-six of the participants opted for graduate or undergraduate credit.

Evaluation Results:

Each participant was asked to complete an evaluation form (see Attachment H) before leaving the conference. Session results have been discussed in the section above and show a high mean school indicating participants were very pleased. Participants were also asked to indicate what they liked about the workshop and what they would like to improve. Their comments are listed below:

6. What did you like best about the workshop?

- The opportunity for administrators and instructors from DPI, VTAE and the University to discuss CIM.
- Depth of discussion.
- Sharing of information and insight into other districts and schools.
- Discussion level.
- Good exchange with secondary.
- Too much to mention.
- Common interest and direction of programs.
- The fact that secondary schools were included.
- Sharing, networking.
- The ability to interact with technical school instructors.
- Bob Meyer and Frank Zenobia
- Open communication, good exchange of information, excellent spirit among participants, good management and planning. Kudo's to Howard Lee, Tim Mero, Orville Nelson.
- Small groups.
- Quality of presentations, networking with other schools.
- Getting together.
- The culmination of a statewide initiative was the highlight-we now will be able to move ahead.
- I believe something significant will be a result of the conference. Good job!
- Sharing.
- Seeing what is happening in other districts and in the industry today. The small group discussions were also great!
- Group interaction, small group discussions.
- Helping the VTAE to get together and give direction to CIM.
- Interaction and sharing of experiences, etc., by all members of the conference.
- Bringing in resources like Don Manor and Frank Zenobia.
- All three levels meet together.
- Everyone on all levels had input. I liked this. Also we had direction and I feel some committees will be developed and some progress will be made for all tech. ed. programs in CIM.
- Just to have the opportunity to be involved was most worthwhile. Good start on communications.
- Technical college presentations gave a good picture of CIM. Small groups with secondary and postsecondary were very good.
- This was a very worthwhile workshop! Good organization and excellent food and accommodations.
- Very good workshop. Thanks!

7. What could be improved?

- Continue the effort.
- Articulation and sharing of information between secondary schools and tech schools.
- Continue this service.
- What needs to be done to successfully integrate this.
- Better pictures on the Stout presentation.
- Day was too long.
- Better room.
- Include business leaders in future meetings to get their guidance/approval on what we are doing.
- Need follow-up to implement recommendations.
- I think a "study group" meeting, at the "buck," (informal get-together), could do more to break down the barriers and create friendships, than some meetings could. I would suggest it be done at the end of the first day.
- Probably the best individual objective conference attended - information - education and direction.
- Continue the good work. I am pleased I was here and feel it was very worthwhile.
- It was all very good.
- If possible, more time for presenters, such as Frank and Don.
- Some of the reports could be a little shorter, especially the first day, because of the long drive.
- Communications to share, "do not redevelop the wheel." Involve other schools, DPI. Expand DPI/VTAE articulation projects.
- It was embarrassing to see the UW-Stout person have poor transparencies and slides in backwards!

Conclusions:

1. Evaluation results and feedback from participants indicate that this was an above average to excellent conference.
2. Participants felt that the District sharing of their programs was important and useful.
3. It was apparent by the presentations that each district tends to emphasize certain aspects of CIM. They also recognize the commonality as evidenced by their summaries of the groups discussions.
4. A follow-up meeting in the future was suggested by a number of participants to see how Districts have progressed.
5. A definite need expressed was to develop a task force or advisory committee to suggest future direction of CIM across the State.
6. The interaction of postsecondary and secondary teachers was positive. Articulation efforts continue to be a major thrust of the State, and the process used in this workshop facilitated cooperation.
7. The networking among technical colleges was felt to be extremely useful. All districts felt they could learn from each other and they now have a contact to share information with.

ATTACHMENT A

Agenda & Participant List

CIM Conference
June 6, 1990

AGENDA

Day 1

Ballroom AB
University of Wisconsin-Stout
Student Center

Registration and Coffee	8:15 - 8:45
Welcome and Workshop Objectives - Orville Nelson	8:45 - 9:00
Presenter: CIM-An Industrial Application Don Manor, John Deere	9:00 - 10:00
Break and Discussion	10:00 - 10:15
Technical College Presentations	
Chippewa Valley Technical College	10:15 - 10:50
Fox Valley Technical College	10:50 - 11:25
Gateway Technical College	11:25 - 12:00
Lunch (Ballroom C) - Continue Discussion	12:00 - 1:00
Technical College Presentations (con't.)	
Lakeshore Technical College	1:00 - 1:35
Milwaukee Area Technical College	1:35 - 2:10
Northcentral Technical College	2:10 - 2:45
Break and Discussion	2:45 - 3:00
Western Wisconsin Technical College	3:00 - 3:35
CIM at UW-Stout - Bob Meyer	3:35 - 4:10
General Discussion/Questions	4:10 - 5:00
Informal Discussion (Ballroom C)	5:00 - 5:45
Dinner (Heritage Room)	5:45 - 6:45
Speaker (Ballroom A): Future of CIM Frank Zenobia	6:45 - 7:45

CIM Conference
June 7, 1990

AGENDA

Day 2

Ballroom AB
University of Wisconsin-Stout
Student Center

Orientation to the Objectives
for the day - Orville Nelson 8:30 - 8:45

Small Group Discussions (Groups comprised
of a cross-section of participants.) 8:45 - 10:45
* CIM Components
* CIM Competencies
* Articulation Linkages
* Break at 10:00

Small Group Reports (10 min. each) 10:45 - 11:45

Lunch and Discussion (Ballroom C) 11:45 - 12:45

Small Group Discussions 12:45 - 2:45
(Groups formed by Education Level -
secondary and technical colleges

- * CIM mission/position statement
for:
 - High School Programs
 - Technical College Programs
 - College Programs
- * Curriculum development work
needed
- * Future Direction

Break and Discussion 2:45 - 3:00

Small Group Presentations 3:00 - 4:00

Wrap-up - James Urness 4:00 - 4:20

Evaluation 4:20 - 4:35

Adjourn

CIM Conference Participant List
June 6-7, 1990

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June 6-7, 1990

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Associate Dean, Business & Marketing
Fox Valley Technical College
1825 North Bluemound Drive
PO Box 2277
Appleton, WI 54913-2277

Fred Skebba, LVEC
Lakeland Union High School
8669 Old Highway 70 West
Minocqua, WI 54548

Steven Skowronski, CNC
Milwaukee Area Technical College
700 West State Street

Milwaukee, WI 53233

Jon Stevenson
Fox Valley Technical College
1825 North Bluemound Drive
PO Box 2277
Appleton, WI 54913-2277

David Stinnett
Electrical Technology
Milwaukee Area Technical College
700 West State Street
Milwaukee, WI 53233

Terry Tower
Trade & Industry
Gateway Technical College - Racine Campus
1001 South Main Street
Racine, WI 53403-1582

Jim Tucker
Electromechanical
Northcentral Technical College
1000 Campus Drive
Wausau, WI 54401

Charles Wright
Grantsburg School District
Box 9
Grantsburg, WI 54840

Robert Zuleger, Instructor
Wausau West High School
1200 West Wausau Avenue
Wausau, WI 54401

ATTACHMENT B

Letters

«Data CIM T&I Coord. Mailing Label



April 9, 1990

«line 1»

«line 2»

«line 3»

«line 4»

«line 5»

Dear «salutation»

The Wisconsin State Board of Vocational, Technical and Adult Education and the Center for Vocational, Technical and Adult Education, University of Wisconsin-Stout are conducting a staff development project to bring together the postsecondary VTAE technical colleges and the University of Wisconsin-Stout members who are working with Computer Integrated Manufacturing (CIM). Project participants will:

1. discuss program content
2. identify areas that need further development
3. determine how these programs can be articulated

In addition, the project will involve a sample of high schools that are working on CIM related programs in order to identify areas of articulation between high schools and postsecondary programs.

The specific objectives of the project are listed on the attachment along with the June 6-7, 1990, agenda.

We are asking your district to participate in this workshop by:

1. Developing a five to seven minute video tape of your CIM cell/program. You will be reimbursed \$250 for this video tape.
2. Present a twenty-five minute overview of your CIM cell/program during the first day of the conference. This time will include the five to seven minute video tape.
3. Sending one or two participants to the workshop. These people will make the presentation.

Please complete the attached registration form and send it to the address indicated on the form by **Wednesday, May 9, 1990**. A confirmation letter will be sent to registered participants prior to the workshop.

Page 2
CIM Staff Development
April 9, 1990

Lunches during the June 6-7, 1990, workshop and the banquet dinner meal on June 6, will be covered by the project. A single occupancy room has been reserved for your College at the Best Western Holiday Manor Hotel. The project will pick up one room per school presenting. Send the name(s) of the participants from your district. We will contact the motel. Please do not contact the motel directly. The project will also reimburse each district for one vehicle (round trip).

We are looking forward to your involvement in clarifying the scope and direction of CIM in the State of Wisconsin.

Sincerely,

Howard D. Lee, Co-Director
(715)232-1251

Orville Nelson, Co-Director
(715)232-1362

Center for Vocational, Technical and Adult Education
218 Applied Arts Bldg.
Menomonie, WI 54751

dmd

«DATA CIM-Inst. Services Director

UNIVERSITY OF WISCONSIN
STOUT
MENOMONIE WISCONSIN 54751

April 9, 1990

«line 1»
«line 2»
«line 3»
«line 4»
«line 5»

Dear «salutation»:

The Wisconsin State Board of Vocational, Technical and Adult Education and the Center for Vocational, Technical and Adult Education, University of Wisconsin-Stout are conducting a staff development project to bring together the postsecondary VTAE technical colleges and the University of Wisconsin-Stout members who are working with Computer Integrated Manufacturing (CIM). Project participants will:

1. discuss program content
2. identify areas that need further development
3. determine how these programs can be articulated

In addition, the project will also involve a sample of high schools that are working on CIM related programs in order to identify areas of articulation between high schools and postsecondary programs.

The specific objectives of the project are listed on the attachment along with the June 6-7, 1990, agenda.

Your district is invited to send a participant to this workshop. Please complete the attached registration form and send it to the address indicated on the form by **Wednesday, May 9, 1990**. A confirmation letter will be sent to registered participants prior to the workshop.

Mileage and motel costs for your participant will NOT be covered by the project. Meals and coffee breaks will be provided through the project.

Call the Best Western Holiday Manor Hotel (715-235-9651) directly for lodging arrangements, noting you are attending the CIM Workshop. A block of rooms has been reserved. We are looking forward to your participation in the project.

Sincerely,

Howard D. Lee, Co-Director
(715) 232-1251

Orville Nelson, Co-Director
(715) 232-1362

Center for Vocational, Technical and Adult Education
218 Applied Arts Building

Enclosures: Objectives
Agenda
Registration Form (C)
Return Envelope

cc: District Director
T & I Coordinator

UNIVERSITY OF WISCONSIN
STOUT
MENOMONIE WISCONSIN 54751

April 9, 1990

«line 1»
«line 2»
«line 3»
«line 4»
«line 5»

Dear «salutation»:

The Wisconsin State Board of Vocational, Technical and Adult Education and the Center for Vocational, Technical and Adult Education, University of Wisconsin-Stout are conducting a staff development project to bring together the postsecondary VTAE technical colleges, University of Wisconsin-Stout staff members, and high school teachers who are interested in Computer Integrated Manufacturing (CIM). Project participants will:

1. discuss program content
2. identify areas that need further development
3. determine how these programs can be articulated

The specific objectives of the project are listed on the attachment along with the June 6-7, 1990, agenda.

We are inviting your district to send a participant to this workshop. It is recommended that a technology education teacher be selected to attend. Please complete the attached registration form and send it to the address indicated on the form by **Wednesday, May 9, 1990**. A confirmation letter will be sent to registered participants prior to the workshop.

The Center for Vocational, Technical and Adult Education through its High Technology project will cover the travel costs of one teacher from your school district. Your participant will be reimbursed for mileage at \$.24 per mile and meal costs while at the Conference. Meal costs en route to and from the Conference will not be covered. The motel reservation will be made through our office. Please fill out the enclosed form and return it to us. This information will be used to make the motel reservation.

Because of space limitations and the small group discussion sessions we will not be able to accept more than one person from each school. We are looking forward to your involvement in clarifying the scope and direction of CIM in the State of Wisconsin.

Sincerely,

Howard D. Lee, Co-Director
(715) 232-1251

Orville Nelson, Co-Director
(715) 232-1362

Center for Vocational, Technical and Adult Education
218 Applied Arts Building
Menomonie, WI 54751

Enclosures: Objectives
Agenda
Registration Form (B)
Return Envelope

CIM Conference

Registration Form A

Directions: Please identify the people who will attend the conference below. Also, indicate who will make the presentation on your college's CIM program. Return by May 9.

1. Name _____ Date _____

• School Address _____

City _____ State _____ Zip _____

• Home Address _____

City _____ State _____ Zip _____

• Phone: School (____) _____ Home (____) _____

2. Name _____ Date _____

• School Address _____

City _____ State _____ Zip _____

• Home Address _____

City _____ State _____ Zip _____

• Phone: School (____) _____ Home (____) _____

This information will be used to reserve a motel room for your participants and register them for the Conference.

Please return to: Howard Lee
Center for Vocational, Technical
and Adult Education
University of Wisconsin-Stout
Menomonie, WI 54751

UNIVERSITY OF WISCONSIN
STOUT
MENOMONIE WISCONSIN 54751

April 16, 1990

James Urness
Bureau Director
Wisconsin Board of Vocational, Technical
and Adult Education
310 Price Place
P. O. Box 7874
Madison, WI 53707

Dear Jim:

Thank you for agreeing to provide the wrap-up for the Computer Integrated Manufacturing (CIM) Workshop on June 7, 1990, from 4:00 - 4:20 p.m. in Ballroom B and C of the Student Union of the University of Wisconsin-Stout. The agenda for the two day workshop is attached. You are welcome to join us earlier and participate in the workshop. If you feel others at the Board are interested in this workshop, have them join us. Let us know who will be attending so we can get an accurate meal count.

You can call the Best Western Holiday Manor Motor Lodge, Menomonie, WI (715-235-9651 or 1-800-528-1234), to make a room reservation. Please identify yourself as a CIM Workshop participant.

A map of the University of Wisconsin-Stout is enclosed for your convenience. Summer school will not start until the following week, and adequate parking will be available. We will send you a parking permit in May.

Call me if you have any questions.

Sincerely,

Howard D. Lee, Co-Director
Center for Vocational, Technical and Adult Education

dmd

Enclosures: Agenda
UW-Stout Map

ATTACHMENT C

Correspondence from Jean Burns

MEMORANDUM

TO: Orville Nelson, Co-Director CVTAE, UW-Stout
Howard Lee, Co-Director CVTAE, UW-Stout

FROM: Jean Burns *JB*

SUBJECT: CIM

DATE: March 9, 1990

Enclosed is a copy of our "CIM Strategic Plan." Mike Tokheim and I have been working on this plan to accomplish several things: (1) give us some guidelines on what to do with regular programming, advance technical certificate offerings, and technical assistance, (2) give us some guidelines on funding request, and (3) how to meet our supervisors/coordinators/deans and instructor needs in the area of CIM. Our office has spent quite a bit of money thus far on funding "CIM related" activities in the areas of curriculum development, professional development, and equipment. We would like to use the expertise we have developed thus far by the use of this money and also provide an opportunity for the other districts to develop their staff and curriculum in this area of CIM.

Also enclosed is a "draft" copy of a proposal NTC, LTC, and CVTC are putting together to assist Mike Tokheim and myself in providing our supervisors/deans and instructors with education on what CIM is and how it can be applied to current programs, advance technical certificate offerings as well as to "technology transfer" activities such as technical assistance.

Your proposed workshop will be another building stone within our plan. We plan to use your workshop as a kickoff to our activities. We plan to use what is generated by your workshop as a guide and model to be a part of the NTC, LTC and CVTC proposal. Thank you in assisting in this effort.

cc: James Urness, Director of Bureau of Program Development and Operations
Salvatore Notaro, Section Chief, WBVTAE
Mike Tokheim, Business Education Consultant

COMPUTER INTEGRATED MANUFACTURING/COMPUTER INTEGRATED BUSINESS STRATEGIC PLAN

GOAL: To meet Business and Industries and students needs in the area of CIM/CIB.

Objectives:

1. To implement CIM/CIB principles into regular programming where applicable.
2. To develop students to work as a "team member" upon job placement where applicable.
3. Assist district's supervisors/staff/instructors, as a team, to plan and implement CIM/CIB concepts into regular programming, CIM Advance Certificates, technology transfer activities (i.e., technical assistance, customized training, retraining, etc) where applicable.

Activities:

1. Determine current status of each district in terms of CIM/CIB concepts:
 - a. Supervisor/staff/instructor development
 - b. Equipment/ CIM cells and/or centers
 - c. Programming
 - d. Materials management/accounting
2. State consultants preparation:

Consultants of the following programs must be involved:

Trade and Industry: Electronics/electromechanical
Fluid Power
Machine Tool
Mechanical Design (CAD)
Industrial Engineering Technician
Manufacturing Engineering Technician
Quality Assurance Technician
Automated Manufactured Systems Technician
Computer Integrated Manufacturing Technician
Industrial Maintenance
Machine Maintenance
Mat. Handling/Equip. Robotics Repair
Printing and Publishing
Welding/Fabrication
Packaging Systems

Business/Marketing: Accounting
 Computer Information Systems
 Computer Operator
 Data Entry
 Administrative Assistant
 International Trade Associate
 Marketing-Industrial
 Marketing-Materials Management
 Small Business
 Supervisors Management

- a. Consultants must receive education to the awareness level of CIM/CIB
 - b. Literature review of trends/CIM/CIB within their areas
 - c. Team development of consultants
 - d. Model of CIM/CIB to be developed and implemented by this team of consultants with assistance from districts/UW Stout/ etc
4. Identify what part(s) of CIM should be a part of programming curriculums:
- a. Several schools are already doing this, some as separate courses and some are integrating parts of CIM into programming. Several projects have been funded in this area (See project list)
 - b. Have instructors/supervisors workshops - being done as part of State-Called-Meetings
 - c. Evaluations process is identifying business/industries needs in this area.
5. Joint Business/Trade and Industry/Marketing supervisors state-called-meeting to: discuss CIM principles
 how to implement within programs, advance certificates, transfer of technology activities
 how to network with present systems within districts
 develop networking systems between districts
6. Individual instructor development
- overview of CIM principles
 - what CIM principles are part of their individual program areas
- Instructor/supervisor team development (intedepartment/multi-programs)
- what CIM principles can be implemented as a team
7. Consultation service provided for districts to plan and implement CIM/CIB principles as part of daily routine/ regular programming/ advance certificate offerings/ transfer of technology activities

Participants in activities:

1. State office:

Consultants:

Trade and Industry: Jean Burns
Robert Westby
Marge Woods

Business/Marketing: Mike Tokheim
David Hague

Section chiefs:

Trade and Industry: Salvatore Notaro
Business/Marketing: Mary Lou Steberg

Bureau Director: James Urness

2. Districts:

LTC and NTC - Instructor/supervisor individual development and
team development

Consulting

FVTC - CIM Alliance Regional Training Center

MATC (Milwaukee)

— Adhoc committee from district representatives

3. Universities:

UW Stout - Prepared CIM education model
Researching & developing Technology of Transfer model
Professional development workshops

VTAE SUPERVISOR/INSTRUCTORS' Development in CIM/B Concepts
and CIM/B Model Implementation Plan

I. Purpose: To educate VTAE supervisors and instructors in the concepts and applications of Computer Integrated Manufacturing/Computer Integrated Business (CIM/B) and assist teams of VTAE supervisors and instructors to develop a plan to implement applicable CIM/B concepts into their existing programming, advance technical certificate CIM/B offerings, and technology transfer activities.

II. Developers and implementors of this CIM/B Model and training:

Chippewa Valley Technical College
Lakeshore Technical College
Northcentral Technical College
University of Wisconsin - Stout
State consultants: Jean Burns, T&I, and Mike Tokheim, Business Education

III. VTAE Deans and Associate Deans, Supervisors, Coordinators and Instructors needs:

o Administrators need to promote effective management of CIM/B resources to promote cooperation and eliminate unwarranted duplication of functions between T&I and business.

o Instructors need to cooperatively incorporate CIM/B concepts and skills throughout the technology appropriate curriculum.

(to be developed)

IV. ACTIVITIES:

1. Develop CIM/B Model. Teams of deans, supervisors and instructors will be educated on planning and implementation of CIM/B model within their curriculums and within various departments at their schools. These teams will be visited on site by consultants from either CVTC, LTC, or NTC to help them develop plans, resources and implementation strategies.

Staff required: CVTC, LTC, and NTC will need one project director
(1 FTE a piece, with a total of 3 FTEs)

CVTC - 6 team members (T&I & Business Ed), 160 hours per team member
LTC - same as CVTC
NTC - same as CVTC

2. CVTC, LTC, and NTC staff development activities. Staff will receive educational opportunities that are necessary to establish CIM/B Models statewide.

Conference/Workshop/Tng source	# of staff	Cost
--------------------------------	------------	------

3. Educate VTAE Deans and instructors:

- a. Individual development within program areas
Instructors will receive an awareness and exploratory experience in CIM/B and then specific education on CIM/B principles that apply in their program function.

Instructors of the following program areas will be included in the CIM/B Training workshops:

90/91 91/92 92/93

Electronics/electromechanical
Fluid Power
Machine Tool
Mechanical Design (CAD)
Industrial Engineering Technician
Manufacturing Engineering Technician
Quality Assurance Technician
Automated Manufacturing Systems Technician
Computer Integrated Manufacturing Technician
Industrial Maintenance
Machine Maintenance
Mat. Handling/Equip. Robotics Repair
Printing and Publishing
Welding/Fabrication
Packaging Systems

Accounting
Computer Information Systems
Computer Operator
Data Entry
Administrative Assistant
International Trade Associate
Marketing - Industrial
Marketing- Materials Management
Small Business
Supervisors Management

T&I and Business Deans, supervisors/coords

b. Team Development:

The above individual training will be formed into teams from each district and taught as teams on how to plan and implement CIM/B concepts into applicable areas of curriculum (regular programming, advanced technical certificates, transfer of technology related activities)

Education will be directed towards the team's school's resources: i.e, program oriented, equipment and resources, etc.

Teams will be visited on site by staff members of CVTC, or LTC, or NTC, at their schools to follow up on their plan to implement the model. They will be given advice from lessons learned on curriculum development, equipment, networking, structure, etc.

V. Timelines

ATTACHMENT D

Slide Script from Don Manor

University of Wisconsin - Stout CIM Conference Presentation
Menomonie, Wisconsin - 6 June 1990

CIM at John Deere

1. John Deere logo
 - Multi-national company
 - 20 factories in 12 countries and a worldwide network of about 5000 dealers
 - Total employment of 38,900 people - fiscal year end 1989
2. Corporate headquarters - Administrative Center (with swans)
 - Moline, Illinois
 - 1989 fiscal year sales of \$7.2 billion
 - in business for 153 years under the John Deere name
3. Steel plow
 - solved the problem of getting sticky soil off the plow
 - John Deere inducted into Inventor's Hall of Fame in February 1989
4. 4WD Tractor and Old Tractor - the long green line
5. Agricultural products - composite
 - World's largest producer of agricultural equipment
 - Products include a full line of tractors, combines, plows, planters, cotton pickers and hay and forage equipment
6. Industrial products - composite
 - Broad line of industrial equipment including crawler tractors, scrapers, motor graders, loader/backhoes, excavators and forestry equipment
7. Lawn tractor
 - Our Consumer Products Division produces a full line of grounds care and golf and turf products for residential and commercial use.
8. New Deere ventures
 - Financial - Farm Plan (Mastercard for farmers)
 - John Deere Insurance
 - Heritage Health Plan (HMO operation and consulting)
 - Major OEM supplier of castings and components
 - Rotary engine manufacturer
 - Golf & turf equipment
 - Deere Tech Services

9. Manufacturing processes - composite
 - Typical metal processing processes such as turning, drilling, cutting, bending, painting and assembly
10. The CIM Evolution
 - History
 - Integration
 - Strategy
 - Future
 - Demonstrating CIM
11. Demands of the 70's
 - High demand for our products
 - Intense competition for scarce resources
 - Increasing government regulations
 - Rising energy costs
 - Large production requirements overrode operational inefficiencies
12. Critical evaluation of key manufacturing facilities in the mid-70's revealed:
 - Very complex material flow patterns
 - Excessive production lead times including a long time to introduce new products
 - Excessive Work-In-Process inventories
 - Excessive material handling and associated costs
 - Excessive expediting and stock chasing
 - Low capital asset utilization
 - Manageability problems and lack of focus
13. Downtown Waterloo factory - 1975
 - Over 5 million square feet
 - Built over the past 75 years - grew like topsy
 - Typical old architecture, inflexible to change, less than ideal working conditions
14. Redevelopment Plan
 - Reorganize and simplify operations
 - Rebuild and add equipment
 - Apply Group Technology philosophy
15. New Tractor Works - "Green field " site
 - New opportunity on a fresh site; no need to carry old problems into new production

16. Tractor Works layout with 9 major systems:
 - Receiving and storage system
 - WIP/WPB storage system
 - Paint and conveyor system
 - Tire and wheel storage system
 - Inter-building delivery conveyor system
 - Chassis assembly/finish trim storage system
 - Tractor assembly conveyor system
 - Finished assembly storage system
 - Tractor repair tracking systems

Now, let's take track some of the major components as they come together to produce a finished tractor

17. Engine coming overhead to assembly line
18. Transmission coming to assembly line
19. Robot chassis painting
20. Robot and manual welding of a Sound-Gard cab
21. E-coat paint system for Sound-Gard cab
22. Sound-Gard cab coming to assembly line
23. Wheel & tire assembly
24. Tire going onto overhead delivery system
25. Tire coming to tractor
26. Tires on tractor - more coming overhead
27. Benefits of the new Tractor Works project
 - Improved product quality
 - More efficient assembly
 - Reduced inventories
 - Shorter lead times
 - Improved working environment

28. 1981 LEAD Award
 - Given annually to a team of manufacturing professionals for their outstanding leadership in Computer Integrated Manufacturing
 - First award by the Computer and Automated Systems Association of SME given to the John Deere Tractor Works team
29. Completed Tractor Works
30. Manufacturing Directions
 - Increasing competition - particularly from off-shore
 - Higher quality at lower cost (new customer expectations)
 - Shorter lead times
 - Reduced inventories
 - Greater flexibility for product change and product mix changes
 - Focused cells
 - Just-In-Time production
 - Functional integration
31. The CIM Challenge (Dave Scott's slide)
 - To manage information efficiently in the factory of tomorrow
---- Emphasize INFORMATION!! ----
32. CIM Evolution Missing Links - Management
 - Opportunity
 - Functional Analysis
33. CIM Evolution Missing Links - Management (continued)
 - Computer Management
 - Technology
34. CIM Evolution Missing Links - Management (continued)
 - Change Management
35. CIM Evolution Missing Links - Management (continued)
 - Economics
 - Personnel
36. CIM Evolution Missing Links - Technical
 - Standards
37. CIM Evolution Missing Links - Technical (continued)
 - Part Description
 - Part Features Availability

38. THE LANGUAGE OF...

...CAD/CAM is <u>Geometry</u> - "Line" - "Arc" - "Circle"	...CIM is <u>Features</u> - "Edge" - "Fillet" - "Hole"
--	---
39. CIM Evolution Missing Links - Technical (continued)
 - Interface Hardware
 - Interface Software
40. CIM Evolution Missing Links - Technical (continued)
 - Computer Power
 - Distributed Computing
41. "COMMON" Systems - Planning systems (all mainframe and IMS based)
 - Product specifications
 - Master schedule
 - Materials Requirement Planning (MRP)
42. "COMMON" Systems - Manufacturing
 - Work force - Machine load planning
 - Manufacturing Engineering - shop floor documents, tool ordering and tracking
43. "COMMON" Systems - Delivery
 - Interfactory (CWIS)
 - Purchasing (CPS)
 - Supplier Delivery System (SDS)
44. GT - Key to manufacturing rationalization
45. Scattered selection of several hundred rotational parts
46. Rationalized families for the same parts
47. Group Technology
 - Develop common solutions to similar problems
48. GT Applications - emphasis on data

- Design for manufacturability - Work simplification - Value Engineering - Manufacturing cell development - Equipment modernization - Coordinated purchasing	- Out-sourced manufacture - Tool control - Reduce setups - Plant layout - Scrap salvage
---	---

49. Traditional Manufacturing (Mike Boyd's slide)
 - Large lot production
 - High inventory levels
 - Functional departments
 - Material queues
 - High material handling costs
 - Long lead times
 - Priorities set by expediting
50. Parts Routing through Factory - 3 parts
 - Lots of backtracking
 - Traditional functional departments
51. Reorganization - Same 3 parts with Cellular Manufacturing
 - Comparison of the "old" and the "new"
52. Achievable Goals
 - Manufacturing lead time 60% reduction
 - Breakeven 55% reduction
 - Material codes 67% reduction
 - Capacity +40%
53. Achievable Goals (continued)
 - Material cost 15% reduction
 - Material handling 40% reduction
 - Direct labor 10% reduction
 - Job change/occurrence 80% reduction
 - Inspection 55% reduction
 - Defective material 50% reduction
 - Warranty costs 55% reduction
 - Salaried staff 25% reduction

One time costs

Inventories 80% reduction

54. GT Data Base - production data
 - Downloaded with data from production systems on a regular basis
 - Quote from Dave Kelly, Manager of Computer Systems at our Horicon factory in the 3 March 1989 issue of "The Business Week Newsletter for Information Executives":

"GT holds all the information we need: classification, process-to-manufacturing, product quantities, order quantities, routings on the shop floor, and material handling. GT pulls in all into one standardized format. Key words are used to feed the data in and extract information for whatever information they want to get their hands on." He goes on to say, "I can't imagine getting along without GT. It's integral to the decision-making that goes on. MIS people are responsible for all the information on the factory floor, and GT is a place where we can put that information in one common place, where people can extract what they need and use it on their own. It relieves us of work and means more information for them."
55. GT Startup savings - first two years of operation
 - \$9,000,000 in documented savings
 - 2,900 applications
 - over 500 trained users
 - Ad hoc problem solving
56. Levels of Improvement
Percent of TOTAL
mfg. cost reduction
 - 5 to 10% - Add technology and systems
 - 10 to 20% - Above plus streamline the material flow through manufacturing
 - 20 to 40% - Above plus streamline the product design
57. 120 Series hydraulic cylinder
 - Manufactured by our Harvester - Moline plant
 - Cylinder Division in danger of going out of business two years ago
58. 120 Series Strategic Analysis
 - Family design
 - Cellular manufacturing
 - Correlation of purchased parts

- 59. 120 Family Design/Cellular Manufacturing
 - Part numbers reduced from 405 to 75
 - Inventory reduced from 21 days to 10 days
 - Setup time reduced 75%
 - Lead time reduced 42%; more now (new cylinder in less than a week)
 - Material handling reduced 42%
 - Scrap reduced 80%
- 60. Traditional Factory Organization
- 61. New Dubuque Works Organization
- 62. Harvester Works - Aerial Front View
- 63. Demonstrating CIM - Pilot - Purpose and Goals
 - Purpose - to demonstrate CIM while establishing tools and directions for the future
 - Goal - Reduced manufacturing costs
- 64. Demonstrating CIM - Pilot - Approach
 - A pilot CIM project for the Harvester Works spanning design through Inspection for sheet metal parts to be manufactured in a dedicated laser punch press with laser and CNC shear cell
- 65. CIM Pilot Work Packages
 - Group Technology Analysis
 - Local Area Network
 - Part Data Base with Features
 - Computer-Aided Process Planning
 - Automatic Nesting
 - Distributed Numerical Control
 - Automated Inspection
- 66. "Simplification before Integration"
- 67. Pilot/Phased Approach
 - Low cost
 - Low risk
 - Learn as you go
 - Leverage efforts
 - Influence vendors with success from the pilot
 - Spread concepts rapidly - move on to larger projects
- 68. Harvester Works LAN (MAP network) on factory plot plan

69. CIM Project - DNC/LAN System
70. Harvester Works ME Award for Excellence in Manufacturing
 - Facility was recently recognized as one of the 10 best manufacturing facilities in America
71. Lessons Learned
 - No "turnkey" system - no magic solutions
 - Importance of standards
 - Need for in-house expertise - can't buy an on-going solution for production
 - Plan ahead for system maintenance, enhancements
 - CIM is evolutionary
72. CIM Future Directions
 - Stick to the knitting
 - Functional integration - particularly of organizations
 - Learn as you go
 - Modular simple software - easier to prototype, maintain
 - Hardware independence
 - Standards - MUST have
 - Watch new external developments - integrate into operations as technology becomes mature
 - Training/technology transfers are critical for long term success
73. Systems alone are not solutions!
74. World-Class Competitor
 1. Satisfies customer's expectation of perceived value
 2. Generates an adequate profit
 3. Competitive with anyone in the world:
 - Function - Services
 - Quality - Responsiveness
 - Price - delivery
 - change
75. PHASE I SIMPLIFICATION
 BEFORE
 PHASE II INTEGRATION
76. Improvement Phases
- | | |
|--|---|
| <u>Phase I</u>
- Streamline
- <u>Simplify</u>
- Focus
<u>Eliminate,</u>
Don't automate waste! | <u>Phase II</u>
- Refine
- <u>Integrate</u>
- Balance
<u>Thrive,</u>
Not just survive! |
|--|---|

77. PEOPLE MAKE THE DIFFERENCE!
LINKS TO WORLD-CLASS SUCCESS

OPENNESS AND HONESTY *lead to* TRUST
TRUST *leads to* COMMUNICATION
COMMUNICATION *leads to* INVOLVEMENT
INVOLVEMENT *leads to* OWNERSHIP
OWNERSHIP *leads to* PRIDE
PRIDE *leads to* COMMITMENT
COMMITMENT *leads to* QUALITY
QUALITY *leads to*:

- lower cost
- increased customer interest
- increased market share
- growth
- improved profitability

78. The Risk of Change
"Can you afford not to achieve these improvements if your competition
does?"

79. The Challenge
"If you are not thinking about how to do things:
Twice as Good
Twice as Fast, with
Half the Resources;
You don't have the right mental attitude to effectively
challenge the global manufacturing competition!"

Source: Gene Adesso, Vice President, IBM

80. John Deere Logo

ATTACHMENT E

Handouts from Technical Colleges

Chippewa Valley Technical College

CIM - Philosophy

- Team Work
- Quality
- Interdependence

*Take away my people, but leave my factories
and soon grass will grow on the factory floors.
Take away my factories, but leave my people
and soon we will have a new and better factory.

-Andrew Carnegie

Associate Degree Program

- Electronics
- Electromechanical
- Mechanical Design
- Fluid Power
- Materials Management
- Supervisory Management
- Industrial Engineering
- Data Processing
- Accounting

CIM Training

- Teamwork
- Management Philosophies
- Organizational Structures
- Quality
- Simultaneous Engineering
- Automation Hardware
- Data Collection Software

CIM Certificate

- Structure of Industry
- Simultaneous Engineering
- Teamwork and Quality
- Automation Hardware

Fox Valley Technical College

Title: Business Applications in the CIM Environment
Credits 12

Courses	Cr
Orientation to Computer Integrated Enterprise	1
Business Function Overview	1
Manufacturing Technologies	2
MAPICS/INMASS Overview	2
Product Structure/Costing	2
Planning	1
Migration Techniques	1
Integrated Systems Application	2
TOTAL	12

Course Descriptions

Orientation to Computer Integrated Enterprise

The student will be presented with an overview of the computer integrated enterprise involving management, engineering and production. Emphasis will be placed upon the technologies involved, the benefits achieved and the integration requirement

Business Function Overview

The course will present an overview of the operating system for an AS400 computer with efficient usage of the system paramount. In a business environment, persons are often expected to have an understanding of word processing capabilities, spreadsheets usages and interoffice communication functions. This course will also introduce the concepts and technologies related to those applications with usage of the computer to support the knowledge acquired.

Manufacturing Technologies

The course will present many of the technologies needed and used within a CIM manufacturing environment with emphasis on the shop floor. Just-in-Time (JIT), Total Quality Control (TQC) and Group Technology techniques will be presented along with the means of analyzing the productive output of everyone within a business through Statistical Process Control (SPC). The inter-relationship of CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) will be highlighted with the implications these technologies have upon the business office arena.

MAPICS/INMASS Overview

The course will present an introduction to, reasons for using and desired aspects within the modules of integrated software. MAPICS is an integrated package run on an AS400-intermediate sized computer, while INMASS is run on a PC. The presentation will give the student a general knowledge of modules desired and aspects of each module to look for within a software package.

Product Structure/Costing

The course provides the means for the student to recognize how a bill of material for a product is created, how the routing representing the product flow through production is determined and how to control the occurrences of the cost elements throughout production. An application of these techniques will be presented.

Planning

The course will provide the student with identification of the techniques of, requirements for and advantages of planning within the production environment. Master Scheduling, the production plan of the business, will be presented with indications of the philosophy behind it and the requirements for it. Material Requirements Planning (MRP) and Capacity Requirements Planning (CRP) are the planning units that aid a business in determining whether or not it has the materials and production capability to produce the master schedule. The student should come away with the techniques required to effectively use MRP and CRP capabilities.

Migration Techniques

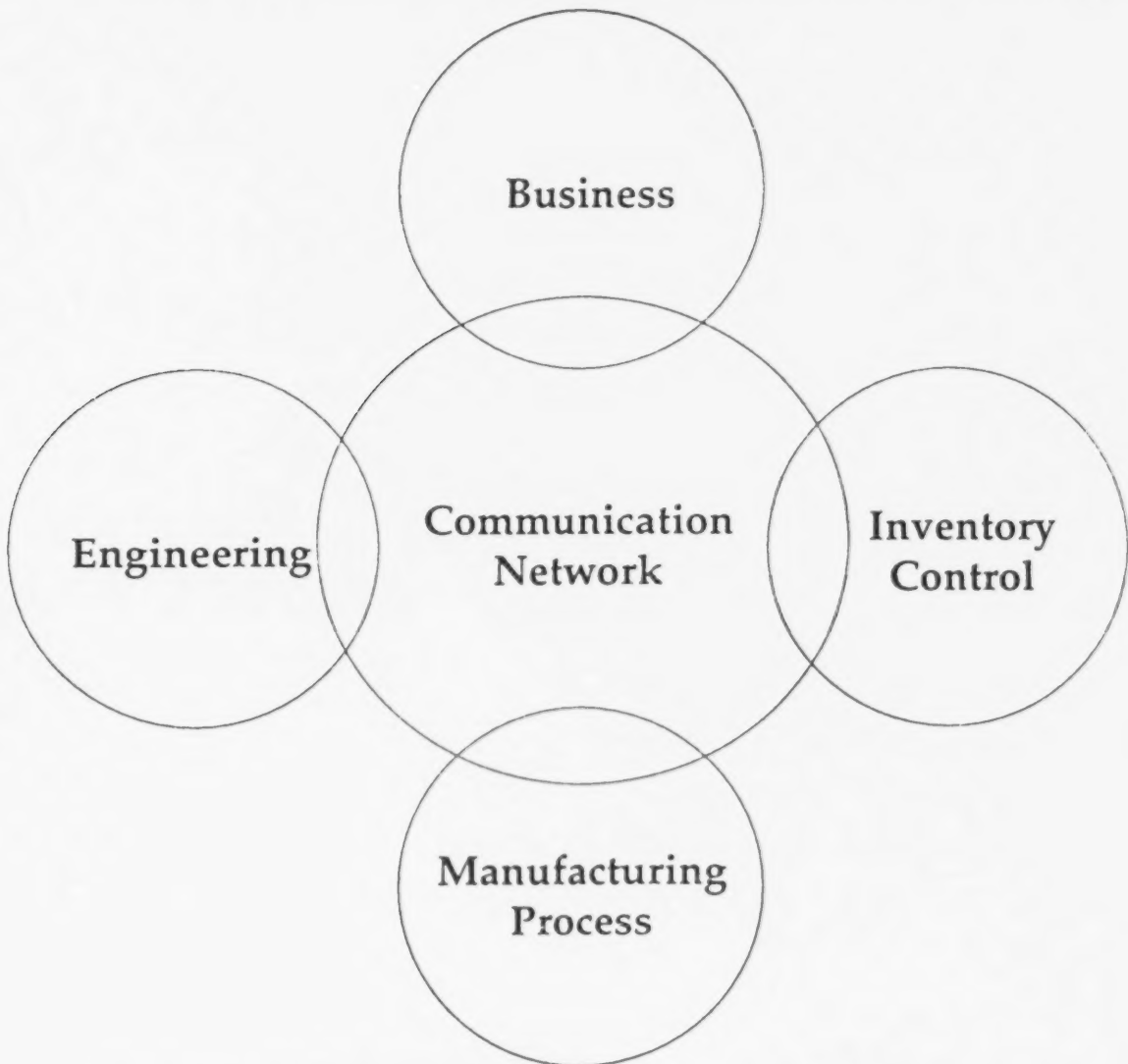
The course will present an overview of the implementation elements and requirements. The student should be able to determine what steps need to be covered if a company decides to start to migrate towards world class manufacturing or CIM. Before any company begins any new process, there must be justification given. The student within this course will be provided with some of the measurement techniques available to demonstrate the need and advantages of the process.

Integrated Systems Applications

In this culminating experience the student will apply the expertise gained to develop an implementation plan for integration between the business function and shop floor operation. The plan will be based upon actual employment situation or case study supplied by the instructor

CIM

Computer Integrated Manufacturing



Educational Products and Services



Introduction

This document has been designed to provide you with information concerning the products and services available through the Fox Valley Technical College, which can assist you in implementing CIM concepts in your manufacturing environment.

Fox Valley Technical College is offering you two services, training of your human resource and technical assistance in CIM implementation. On the following pages you will find descriptions of the courses and seminars that are available to you. In addition FVTC staff members are available to sit down with you to design customized training specific to your needs.

Information concerning CIM products are described under the following categories:

ADVANCED CERTIFICATES

BUSINESS APPLICATIONS

COMPUTER ASSISTED DESIGN

ELECTRONIC PUBLISHING

MANUFACTURING PROCESSES

In each section there is a survey which we are asking you to complete to provide us with information concerning your training and technical assistance needs. This information is necessary for us to plan an efficient delivery system to meet our customer needs.

Computer Integrated Manufacturing Advanced Certificates

Fox Valley Technical College has designed two twelve credit advanced certificate programs to assist individuals with associate or baccalaureate degrees in gaining expertise related to computer integrated manufacturing. On the following pages you will find a description of the courses which make up two certificates Technical Applications in the CIM Environment and Business Applications in the CIM Environment.

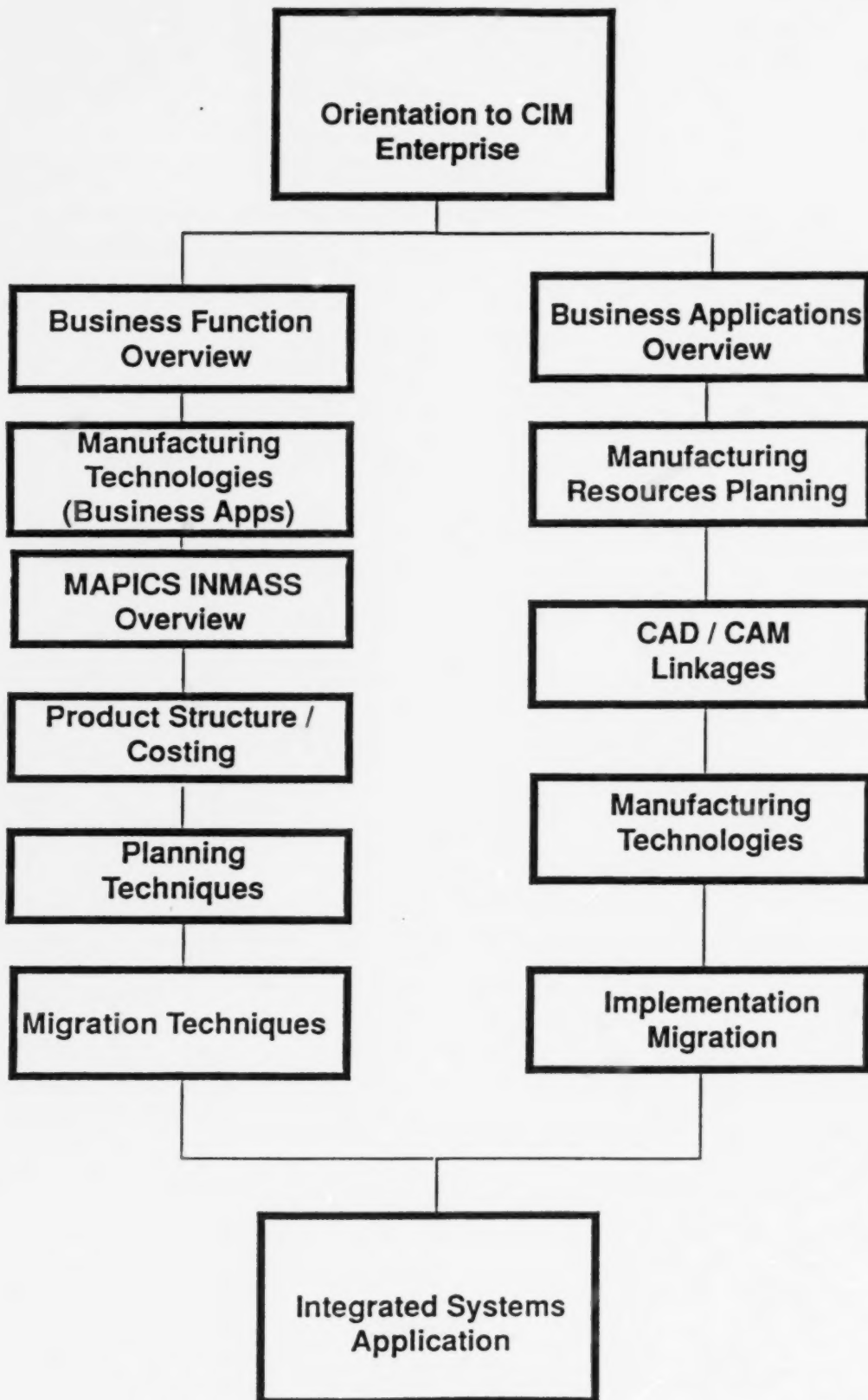
To learn more about these advanced certificate offerings contact:

For: Technical Applications in the CIM Environment

Virgil Noordyk
Technical Division Dean
414-735-5783

For: Business Applications in the CIM Environment

John Ross
Business Division Associate Dean
414-735-2466



Title: Business Applications in the CIM Environment
Credits 12

Courses	Cr
Orientation to Computer Integrated Enterprise	1
Business Function Overview	1
Manufacturing Technologies	2
MAPICS/INMASS Overview	2
Product Structure/Costing	2
Planning	1
Migration Techniques	1
Integrated Systems Application	2
TOTAL	12

Course Descriptions

Orientation to Computer Integrated Enterprise

The student will be presented with an overview of the computer integrated enterprise involving management, engineering and production. Emphasis will be placed upon the technologies involved, the benefits achieved and the integration requirement

Business Function Overview

The course will present an overview of the operating system for an AS400 computer with efficient usage of the system paramount. In a business environment, persons are often expected to have an understanding of word processing capabilities, spreadsheets usages and interoffice communication functions. This course will also introduce the concepts and technologies related to those applications with usage of the computer to support the knowledge acquired.

Manufacturing Technologies

The course will present many of the technologies needed and used within a CIM manufacturing environment with emphasis on the shop floor. Just-in-Time (JIT), Total Quality Control (TQC) and Group Technology techniques will be presented along with the means of analyzing the productive output of everyone within a business through Statistical Process Control (SPC). The inter-relationship of CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) will be highlighted with the implications these technologies have upon the business office arena.

MAPICS/INMASS Overview

The course will present an introduction to, reasons for using and desired aspects within the modules of integrated software. MAPICS is an integrated package run on an AS400-intermediate sized computer, while INMASS is run on a PC. The presentation will give the student a general knowledge of modules desired and aspects of each module to look for within a software package.

Product Structure/Costing

The course provides the means for the student to recognize how a bill of material for a product is created, how the routing representing the product flow through production is determined and how to control the occurrences of the cost elements throughout production. An application of these techniques will be presented.

Planning

The course will provide the student with identification of the techniques of, requirements for and advantages of planning within the production environment. Master Scheduling, the production plan of the business, will be presented with indications of the philosophy behind it and the requirements for it. Material Requirements Planning (MRP) and Capacity Requirements Planning (CRP) are the planning units that aid a business in determining whether or not it has the materials and production capability to produce the master schedule. The student should come away with the techniques required to effectively use MRP and CRP capabilities.

Migration Techniques

The course will present an overview of the implementation elements and requirements. The student should be able to determine what steps need to be covered if a company decides to start to migrate towards world class manufacturing or CIM. Before any company begins any new process, there must be justification given. The student within this course will be provided with some of the measurement techniques available to demonstrate the need and advantages of the process.

Integrated Systems Applications

In this culminating experience the student will apply the expertise gained to develop an implementation plan for integration between the business function and shop floor operation. The plan will be based upon actual employment situation or case study supplied by the instructor

Title: Technical Applications in the CIM Environment
Credits 12

Courses	Cr
Orientation to the Computer Integrated Enterprise	1
Business Applications Overview	1
Manufacturing Resource Planning (MRP)	2
CAD/CAM Linkages	2
Manufacturing Technologies	3
Implementation Migration	1
Integrated Systems Application	<u>2</u>
TOTAL	12

Course Descriptions

Orientation to the Computer Integrated Enterprise

The student will be presented with an overview of the computer integrated enterprise involving management, engineering and production. Emphasis will be placed upon the technologies involved, the benefits and the integration requirement.

Business Applications Overview

The course will provide the student with the opportunity to explore the integrated business enterprise. Emphasis will be placed upon financial applications and costing from order entry to financial analysis.

Manufacturing Resource Planning

The course will examine the application of the manufacturing resource planning role in the computer integrated enterprise. Various business and manufacturing applications such as purchasing, inventory, master scheduling, production control, etc. will be reviewed. Particular attention will be paid to the inter-relationships between the applications and specifically how they affect plant floor operations.

CAD/CAM Linkages

The course will provide the student with an understanding of the communication linkages from computer assisted design to computer assisted manufacturing to computer numerical control. Emphasis will be placed on the implementation of computers in the design of manufactured components (CAD), product engineering (CAE) and tool path creation for computer numeric control (CNC) machines.

Manufacturing Technologies

The course will introduce emerging technologies which are necessary to successfully implement computer integrated manufacturing. Examples of topics that will be covered are statistical process control, just in time, set-up reduction, group technology, etc. Applications of processes related to robotics, vision systems, and bar coding will be covered.

Implementation Migration

The student will gain an understanding of the steps involved in the successful migration toward the implementation of the computer integrated enterprise. The student will gain competency in building a plan to take a company from existing manufacturing conditions on through to implementation of the computer integrated enterprise.

Integrated Systems Application

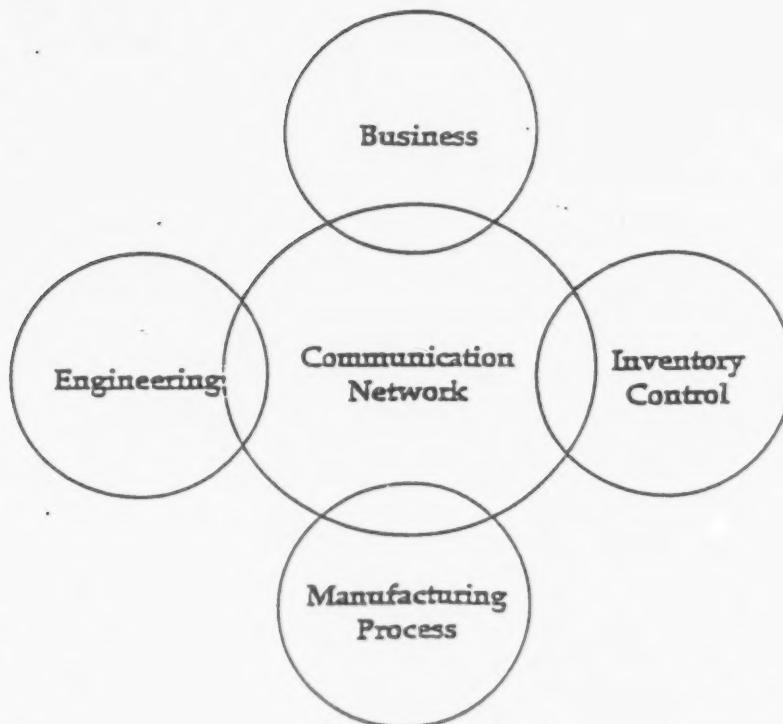
In this culminating experience the student will apply the expertise gained to develop an implementation plan for integration between the business function and shop floor operation. The plan will be based upon an actual employment situation or case study supplied by the instructor.

Business Application

Integration of data bases is the key to implementation of the computer integrated enterprise. MAPICS DB from IBM provides the total manufacturing solution through an integrated approach to successful manufacturing management. MAPICS DB insures that every department has access to consistent, up-to-date information.

On the following pages you will find a description of the educational products available from FVTC which will assist your implementation of the MAPICS DB total manufacturing solution. After reviewing the product descriptions we invite you to complete the interest form communicating to us your educational needs. Please return the completed form to:

Fox Valley Technical College
1825 N. Bluemound Drive
P.O. Box 2277
Appleton, WI 54913
Att. John Ross



MAPICS Application Descriptions

Financial Management & Business Control Applications:

General Ledger (GL):

General Ledger gives you a clear picture of your company's financial standing--monthly, at year-end or any time you wish. You can create journals and ledgers on-line; journal transactions are automatically entered from other MAPICS DB applications. Reports include Income Statement, Balance Sheet, and Last Year vs. This Year vs. Budget.

Financial Analysis (FA):

This module helps you detect significant financial trends that might otherwise be missed. In addition to providing budget planning on general ledger accounts, FA gives you fixed-asset accounting, analyses, financial ratios and provides financial statement reports. It also provides automatic recurring entries and final budget plans to General Ledger.

Accounts Payable (AP):

This application provides an easy, flexible way to manage your cash outflow and take full advantage of cash discounts. It provides accurate, timely information about invoice due dates, vendors and amounts. With this program you can enter and maintain vendor invoices, inquire about aged payables, process cash disbursements and analyze vendor performance. Balanced journal entries can be sent to General Ledger, actual costs can be sent to Inventory Management and outside operation costs and miscellaneous charges can be sent to Production Control & Costing.

Accounts Receivable (AR):

This module lets you minimize your collection period, monitor cash flow and reduce losses due to bad debts. It maintains a status of all customer accounts and posts cash received to open items. It also creates aged receivable reports, monthly statements and delinquency notices, providing credit information in Order Entry and Invoicing.

Payroll (PR):

Plant Operations Applications:

Inventory Management (IM):

This application helps improve plant productivity by improving inventory accuracy and reducing the clerical effort needed to report and post inventory transactions. Detailed inquiries help you maintain constant control of inventory quantities, reducing the manpower required for expediting, taking physical inventory and picking the material need for production or shipment.

Production Control & Costing (PC&C):

This module lets you track the status of each production order. It highlights excessive material and labor costs, pinpoints current locations, and shows time remaining, as well as quantities completed by operation. With this application, you can supply daily prioritized work lists so that work can be sequenced to meet delivery commitments. Rapid transaction reporting assures that you have accurate information for analyzing work center performance and managing WIP.

Production Monitoring & Control (PM&C):

This module, through timely and accurate shop reporting, helps ensure that plant floor transactions are reported accurately, that work is progressing and that orders are being met promptly. It receives manufacturing orders and allows you to add, modify or split them. It also prints bar-coded shop packets and employee badges, prints prioritized updating of the production data base provides more current and more accurate orders.

Purchasing (PUR):

Purchasing allows you to request and maintain valid quoted, gives your buyers more time to qualify and negotiate with suppliers, and analyzes vendor performance. These programs maintain requisition status, requirements and validate vendor invoices.

Production Planning Applications:

Material Requirements Planning (MRP):

With MRP, the master production schedule is exploded into item requirements. The result is a time-phased set of purchasing or manufacturing order recommendations to be executed to achieve the master schedule. The master schedule is used to calculate the projected inventory needs for all material usages based on the bills of material.

Capacity Requirements Planning (CRP):

CRP can project your work load, long and short range, and help reduce bottlenecks. It shows you available capacity in each work area. You can project production schedules, summarize production so that you can analyze the load on each work center and find out the production load in each work center by time period. CRP validates the production capacity to achieve the order recommendations made by MRP.

Product Data Management (PDM):

This application creates and maintains a common item information base for engineering, manufacturing and accounting. PDM provides you with information about items, bills of material, work centers and routings. It lets you perform cost simulations and analyses. Powerful maintenance capabilities such as mass-replace and same-as-except transactions provide a productive tool to keep the data current.

Marketing & Physical Distribution Applications:

Order Entry & Invoicing (OE&I):

This application helps assure that reasonable ship dates are assigned and that inventory and production requirements are coordinated. Customer orders are entered and edited on-line and automatically priced. Customer credit and item availability are checked and the order is allocated to inventory or planned production. This module produces a customer acknowledgement, pick list, bill of lading and invoice. In addition, it maintains back orders, helps calculate commissions and reports order status by item, customer or due date.

Sales Analysis (SA):

Tracking customer and product performance and evaluating the efforts of your sales force are simplified by Sales Analysis. This application analyzes sales and profits by item, customer, and by salesperson, for this year and last year.

Forecasting (FCST):

Forecasting lets you create and maintain forecast models by item and by item family. Using a forecasting technique adjusted by seasonality curves and trend lines, demand history is analyzed and projected into the future. You can compare actual demand to the model, compare product life cycles to forecasts and use the projected demand for planning production in either Master Production Schedule Planning or Material Requirements Planning.

MAPICS DB Instructional Interests

Instructional offerings will be available from FVTC on the following MAPICS DB modules. Please check those that you have an interest in learning about.

Name _____

Address _____

Telephone: _____

Company Name _____

Financial Management & Business Control Application

General Ledger _____
Financial Analysis _____
Accounts Payable _____
Accounts Receivable _____
Payroll _____

Plant Operations Applications

Inventory Management _____
Production Control & Casting _____
Production Monitoring & Control _____
Purchasing _____

Production Planning Applications

Material Requirements Planning _____
Capacity Requirements Planning _____
Product Data Management _____

Marketing & Physical Distribution Applications

Order Entry and Invoicing _____
Sales Analysis _____
Forecasting _____

INMASS

Also available to you is the personal computer based INMASS program instruction.

INMASS II/INCOME II is a tool to aid in the management of a manufacturing facility and an integrated accounting package. INMASS II provides the means for managing inventory, purchasing, order entry, job costing, payroll and material requirements planning. INCOME II includes modules which integrate order entry, accounts receivable, accounts payable, purchasing and inventory with the general ledger. The modular design of the system allows choice of the modules needed by your business.

If you have an interest in this please check the modules that you would be interested in learning about.

INMASS II

Inventory	_____
Order Entry	_____
Purchasing	_____
Job Costing	_____
Bills of Material	_____
Material Requirements Planning	_____
Payroll	_____
Purchasing and Forecasting	_____

INCOME II

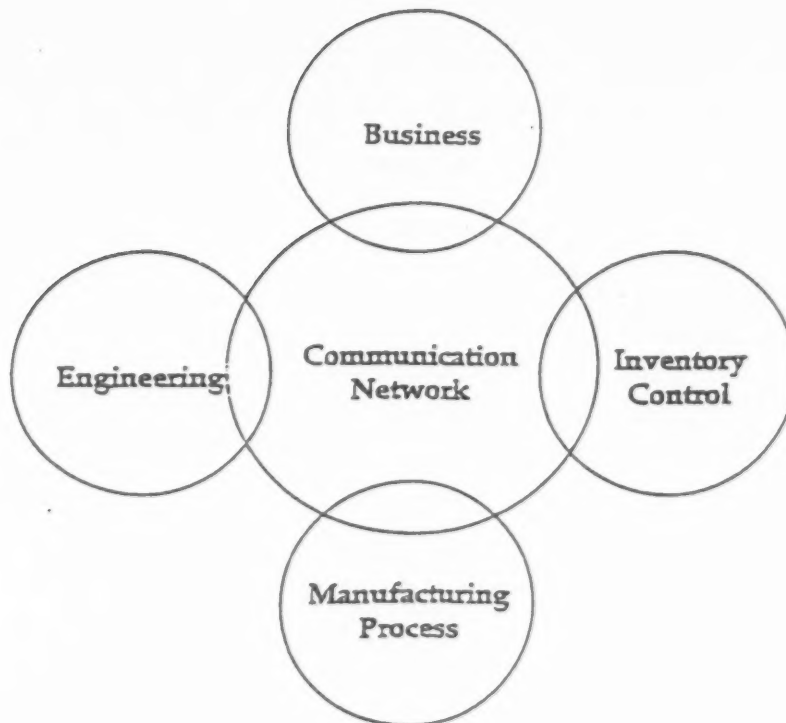
Inventory	_____
Order Entry	_____
General Ledger	_____
Accounts Receivable	_____
Accounts Payable	_____
Payroll	_____
Purchasing and Forecasting	_____

Computer Assisted Design

Integration of the engineering and design functions is essential to implementation of the computer integrated enterprise. Fox Valley Technical College has educational products available which can assist you in implementing computer assisted design concepts.

We invite you to communicate your instructional needs to us by completing the attached CAD product interest survey and returning it to us at the following address:

Fox Valley Technical College
1825 N. Bluemound Drive
P.O. Box 2277
Appleton, WI 54913
Att. Phil Leverault



Computer Assisted Design Course Descriptions

AutoCAD Introduction

This three-day class is aimed at the introduction and development of AutoCAD skills. The course will take the student from a basic level all the way through the completion of production-type drawings. Many AutoCAD commands are introduced as well as productivity skills.

AutoCAD Advanced

This two-day course helps students develop new skills and productivity ideas. Key concepts are used to make your AutoCAD installation more efficient. Concepts covered include advanced dimensioning, polylines and pedit. Productivity ideas with divide, measure, trim and attributes are covered. Prerequisite: AutoCAD-Introduction or equivalent.

IBMCAD

This course will introduce the students to IBMCAD. the student will be taught the methods of implementing IBMCAD, drawing techniques and plotting the finished product.

Commands will include line, arc and circle construction, copying, moving and modifying existing entities. The course will also cover macro generation, and DXF files for exchanging information with AutoCAD, CADAM and CATIA.

AutoLISP Introduction

AutoLISP is a programming language that is imbedded in AutoCAD. It is not difficult to use and is very productive in the automation of AutoCAD commands and drawing capabilities. This course gives students background information about AutoLISP. AutoLISP can be used to develop single letter commands or do complete drawings automatically. It can be used to rewrite commands within AutoCAD to comply with your own needs. Prerequisite: AutoCAD-Introduction or equivalent.

3D AutoCAD

This course will clear up the mysteries of 3D. It takes the student through the 3D world of AutoCAD. The student will learn about UCS, WCS, 3D filters, faces and surfaces, as well as extraction of 3-view drawings, plus a pictorial from the 3D drawings. Prerequisite: AutoCAD-Introduction or equivalent.

MS-DOS For AutoCAD

This one-day intensive course covers the MS-DOS operating system. Students learn the DOS commands that are essential in running an AutoCAD environment. They cover tree-structure, directories, subdirectories, batch files, file manipulations and backups, along with management of these files.

Customizing AutoCAD

Customizing AutoCAD will involve menu macros, menu generation (screen pop-up, tablet and icon), text fonts and hatch generation, and line customization. It will also cover script and batch files and how they relate to AutoCAD. This course will make AutoCAD much more productive for all working environments.

Systems Management for PC CAD

Systems Management for PC CAD will provide information on organization, structure and optimization of the CAD system and CAD Department as a whole. The course will cover harddisk management, system management and trouble shooting, personnel management and organizational documentation for the CAD department. AutoCAD, as well as, third party utility programs will be shown and used by the students.

Operating Systems for PC CAD

This course will introduce the student to the various operating systems for the PC. These would include DOS, OS2, and UNIX (XENIX). The student will learn to communicate with the computer through these systems.

CADAM Basic

This course consists of 14 sessions on the basic operations of the CADAM software. CADAM runs on a mainframe computer. The sessions are designed to give students an understanding of the basic CADAM operations through "hands-on" experience. The system is designed to produce mechanical drawings.

CADAM, Intermediate

This course is designed to go beyond basic CADAM skills to a higher level of CADAM proficiency. The course content includes: overlays, details, sets and attributes, engineering change/drawing compare, symbols, advanced dimensioning techniques. Advanced uses of auxiliary views, splines, standard libraries, notes, files, analysis, using colors, kinematics, line widths, offset/flat patterning, and plotting.

3D & Solids CAD

Three dimensional drafting including wireframe, surface modeling and solids modeling uses and methods will be studied in this course. Students will have hands-on on CAD systems like AutoCAD, IBMCAD, CADAM and CATIA. Links between 3-D CAD systems and other CIM and computer aided engineering systems will be explored.

Computer Assisted Design Products

The following instructional offerings are available at FVTC. Please check those offerings that you are interested in learning more about.

Name _____

Address _____

Telephone: _____

Company Name _____

Please check the courses you are interested in:

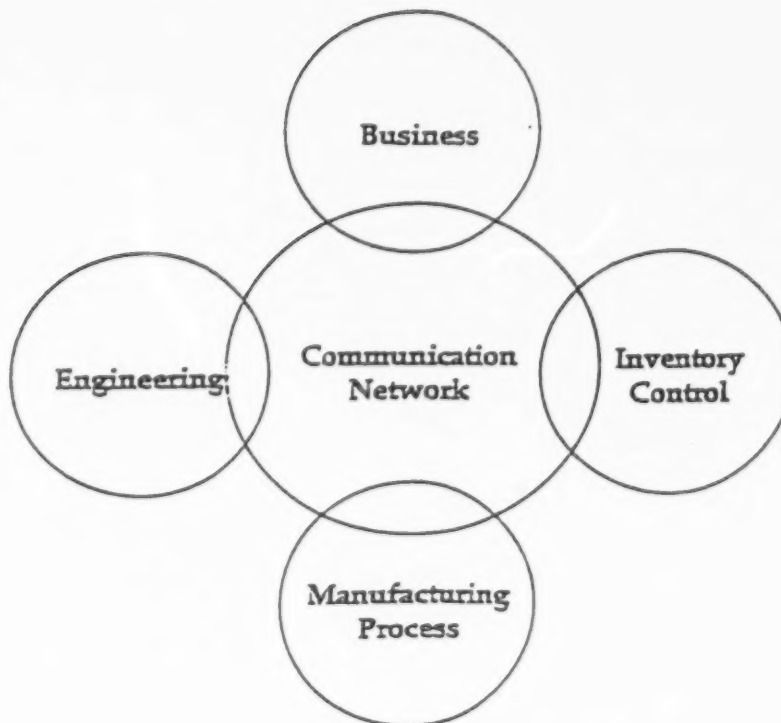
AutoCAD Introduction	_____
AutoCAD Advanced	_____
IBMCAD	_____
AutoLISP Introduction	_____
3D AutoCAD	_____
MS-DOS for AutoCAD	_____
Customizing AutoCAD	_____
Systems Management for PC CAD	_____
Operating Systems for PC CAD	_____
CADAM Basic	_____
CADAM Intermediate	_____
3D and Solids CAD	_____

Electronic Publishing

Product marketing and documentation are an important component of the computer integrated enterprise. On the following pages you will find a description of the electronics publishing products available at FVTC which will assist you in implementing this component of the CIM enterprise.

Also included you will find a form upon which you can communicate your instructional needs to us at FVTC. We invite you to complete this form and return to:

Fox Valley Technical College
1825 N. Bluemound Drive
P.O. Box 2277
Appleton, WI 54913
Att. Doug Paape



Electronic Publishing Course Description

Interleaf Publisher Basic Seminar

The Basic Interleaf Publisher seminar is designed to give the participant an understanding of desktop publishing and the operation of IBM Interleaf Publisher. Opportunity will be provided for each participant to have extensive "hands-on" experience with the program. The seminar will concentrate on the basic features of the program, as well as production of simple documents.

Ventura Orientation

This 8-hour hands-on workshop introduces the basic functions of Xerox Ventura Publisher®. You will be introduced to techniques of document creation, placement of text & graphics, and printing documents using laser printers. Designed for those with little or no experience.

Ventura Business Applications

In the Business Applications workshop, you will learn to produce professional quality business communications and promotional materials--brochures, advertising copy, press releases, memos, presentations and reports. Workshop emphasis is on page layout and visual effects.

Ventura Newsletter

Workshop participants will learn to design and produce unique newsletters without using cut and past methods or expensive outside services. They will review skills and planning, layout, composition and graphics. The workshop's emphasis is on typographic effects and editing.

Ventura Design

You don't have to be an artist to understand the basic elements of effective page layout. This workshop teaches you an eight-step process to guide you in making good decisions about your own layouts and page design. The workshop is conducted with pencil and paper. There is no hands-on computer training or discussion of specific publication products. This workshop is recommended for anyone who is involved in writing or editing, document production or electronic publishing.

Pagemaker Basic

This is a 15-hour hands-on course using Aldus PageMaker in an IBM environment. You will learn to set up a publication, place text and graphics in the document, change text specifications, adjust graphics on the page and print a publication on a laser printer.

PageMaker Advanced

Intended for those who already know the basics, this 15-hour workshop focuses on design concepts, principles and techniques with hands-on applications. You learn to analyze communication problems and design solutions using PageMaker.

Courses being developed for future delivery.

Interleaf Applications Seminar 1

The Interleaf Publisher Applications Seminar 1 will provide the participant with valuable experience producing Technical Publications using Interleaf Publisher. The seminar will also cover basic Layout and Design techniques, which may be applied to all documents.

Interleaf Application Seminar 2

The Interleaf Publisher Applications Seminar 2 will provide the participant with valuable experience producing Business Documents using Interleaf Publisher. The seminar will also cover basic Layout and Design techniques, which may be applied to all documents.

MAC PageMaker

Beginning PageMaker for the Macintosh-- This is an introductory hands-on course using Aldus PageMaker in the Macintosh environment. You will learn to set up a publication, place text and graphics in the document, change text specifications, adjust graphics on the page and print a publication on a laser printer.

MAC Graphics

Graphics on the Macintosh-- This hands-on course will introduce the concepts used to produce graphic images. Study will include creation of graphics using paint programs, draw programs, and scanners, both color and monochrome. Graphic image editing and manipulation will also be covered.

MAC Quark Xpress

Beginning Quark Xpress-- This is an introductory hands-on course using Quark Xpress in the Macintosh environment. You will learn the basic operation of the program such as how to set up a publication, place text and graphics in the document, change text specifications, adjust graphics on the page and print a publication on a laser printer.

Electronic Publishing Instructor Interests

The following electronic publishing courses and seminars are available at Fox Valley Technical College. For additional information concerning course dates and times please provide the following information.

Name _____

Address _____

Telephone: _____

Company Name _____

Please check the courses you are interested in:

Interleaf Publisher	_____
Ventura Orientation	_____
Ventura Business Application	_____
Ventura Newsletter	_____
Ventura Design	_____
Pagemaker Basic	_____
Pagemaker Advanced	_____

Future Courses:

Interleaf Application 1	_____
Interleaf Application 2	_____
MAC Pagemaker	_____
MAC Graphics	_____
MAC Quark Xpress	_____

NC/CNC Programming

This class is for individuals interested in continuing their study into advanced manual NC programming. This class is for individuals who wish to move from basic numerical control programming into the use of the computer on which conversational language and basic G code word addressing format will be used on both mills and lathes.

PREREQUISITE: Numerical Control, Basic, or industrial experience on NC machines.

C Programming Language

Introduces the rudiments of the C programming language including variables and constants, arithmetic, control flow, simple functions, and basic input/output. Participants will write (code, compile, load, and run) several small programs.

Maintenance Management Systems

The course is based upon the use of MAXIMO software as a maintenance accounting management tool. Topics covered are repair part tracking, repair design procedures, order initiation, customizing reports and cost analysis.

Just In Time Manufacturing

The student will learn the concepts of JIT production that directly cuts inventories and reduces the need for storage space and related fixtures. The concepts of JIT as a quality improvement tool will be emphasized.

Robotic Welding

An introduction to the application of the robot to the welding process. The do's and don'ts of implementing robots in welding are discussed. Programming concepts are included.

Statistical Process Control

This course will teach students the correct use and application of various statistical tools of analysis, such as attributes charts, variable charts, pareto analysis and process capability. Technical assistance is available to assist you in making application to your operation.

Design of Experiments

This course will offer to the student an opportunity to learn about an advanced statistical technology. Once learned, the student will be able to produce the quality output at its source (the design). The design of experiment portion of the class teaches students how to set up the variables in a process systematically and sequentially so as to be able to determine which of the variables is having a significant effect on the outcome. Hypothesis testing is an inherent part of design of experiments that will allow students to answer the question of significance statistically.

Introduction to Expert Systems

This course builds the concepts and skills for knowing and using Expert Systems, the powerful productivity tools being implemented with increasing frequency in the work place. The course provides practical training at both the concept and the applications level, with opportunity to analyze an actual work place problem, break it into elements, and produce a functioning Expert System.

Technical Assistance Automated Welding

A automated welding system is available to be placed in your company for a period of 90 days. The intent of this project is to allow you to try robotic welding in your plant on your parts before making decisions about future implementation.

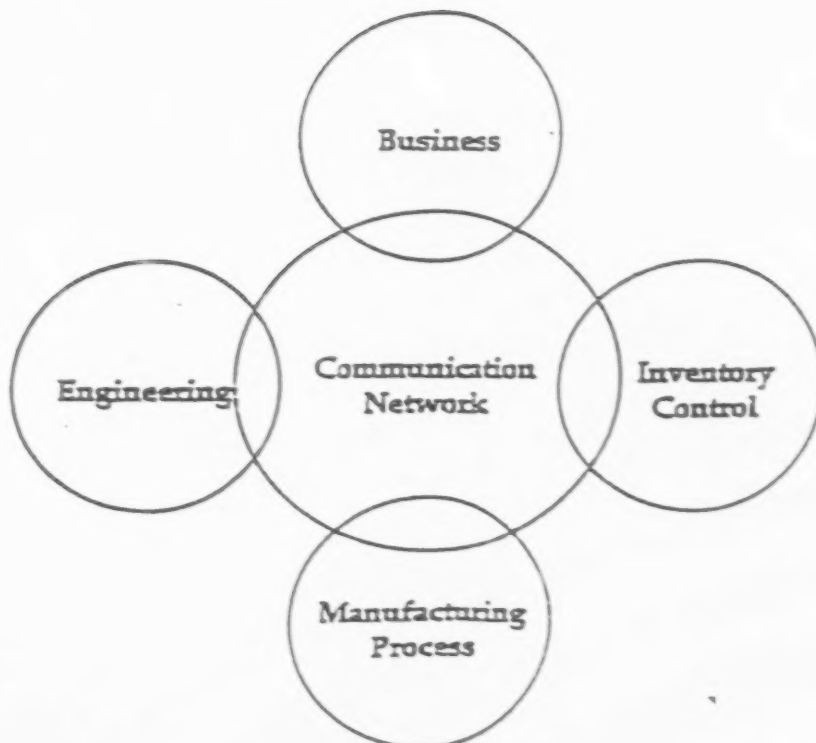
Fox Valley Technical College staff will train your operators and assist you on implementation and application to your product.

Manufacturing Processes

The key to implementation of the computer integrated enterprise is the electronic communication between the business and the manufacturing operations. Fox Valley Technical College has instructional products which can assist you in gaining expertise related to integration of the factory floor operation.

On the following pages you will find descriptions of instructional products available at FVTC. After reviewing these please take the time to complete the interest survey and return it to:

Fox Valley Technical College
1825 N. Bluemound Drive
P.O. Box 2277
Appleton, WI 54913
ATTN: Richard Schmidt



Manufacturing Processes Products Introduction to Automated Systems

Smartcam

An integrated system of different modules for transferring part print information into computer numeric control programming code. The use of the system to integrate the design and manufacturing functions will be taught.

Robotics Introduction

A firm foundation in industrial robotics will be established. The major electronics and mechanics of common robots will be studied. Robot types, typical applications, and end-of-arm tooling will be presented. The programming of pick and place and servo robots will be included.

Introduction to Plant Communications

The student will gain an understanding of the basics of plant communications. Topics include the hierarchy of communications, LANS, media, MAP/TOP and floor level devices.

Programmable Control Introduction

This is an introductory course for the programmable controller. Content will include a review of ladder logic, basic programming, PLC symbols, transferring standard ladder logic to PLC logic and interfacing.

PREREQUISITE: An understanding of direct current, alternate current and ladder logic.

Microprocessors

The microprocessor has revolutionized the electronics field because of its size and capabilities. Students are introduced to its impact in the electronics field, terms used in its operation and application, various number systems, and arithmetic manipulations. The course includes an introduction to programming.

PREREQUISITE: An understanding of the principles of digital logic and the various logic gates.

Numerical Control-Basic

Basic Numerical Control deals with three broad areas of numerical control, namely the basic concepts of numerical process control, the design features and capabilities of NC machines and the economic programming of common types of NC machine tools. This course provides meaningful instruction to students who plan to enter the machining industry as skilled trades people or technical level employees.

Manufacturing Processes Instructional Interests

Listed below are instructional offerings and technical assistance that is available at Fox Valley Technical College. We invite you to communicate your manufacturing training needs to us by completing and returning this form to FVTC.

Name _____

Address _____

Telephone: _____

Company Name _____

Please check the courses you are interested in:

Intro to Automated Systems	_____
Smartcam	_____
Robotics Introduction	_____
Introduction to Plant Communication	_____
Programmable Control Introduction	_____
Microprocessors	_____
Numerical Control Basic	_____
NC/CNC Programming	_____
C Programming Language	_____
Maintenance Management Systems	_____
Just In Time Manufacturing	_____
Robotic Welding	_____
Statistical Process Control	_____
Design of Experiments	_____
Intro to Expert Systems	_____
Technical Assistance Automated Welding	_____

Note: This is only a partial listing of the courses for this program. For a complete description, see the FVTC catalog.

(419-102) Hydraulics

Emphasis will be placed upon hydraulic control circuit development. Basic hydraulics, hydraulic actuators, accumulators, valves, pumps, motors, fluids and filters will be studied.

(419-104) Pneumatics

Emphasis will be placed upon components included in pneumatic control circuits. Basic pneumatic principles, air compression, work devices, control devices and circuit diagrams will be emphasized.

(605-147) Industrial Computer Programming

This course is an introduction to the digital computer. It acquaints the student with the PASCAL programming language, hardware operation and use of the digital computer.

(628-102) Automated Systems, Introduction to

The course introduces the student to the concepts involved in the movement toward factory automation systems dictated by the demands for increased quality and competitive position. Concepts of the factory of the future, such as CIM, parts families and flexible manufacturing, will be covered.

(628-104) Electricity for Electronics

The course is the basic foundation for subsequent systems study. A basic knowledge of direct and alternating current circuits and test equipment is gained through practical application and theory.

Prerequisite: Concurrent enrollment in Math, Technical, Intermediate

An Equal Opportunity Employer and Educator
Operating Under An Affirmative Action Plan



**We Do Not
Succeed Until
You Do!**

Printed with the assistance of Fox Valley Technical College's
Printing program students
2000/12/89

(605-106) Manufacturing Technology I

The course will present an overview of manufacturing processes used in industry. Materials, methods and terminology of common manufacturing techniques will be presented. The common manufacturing techniques will be discussed, and potential for automating will be explained.

(628-106) Digital and Analog Circuits

This course is a study in digital electronics including binary numbers, codes, Boolean algebra, logic circuits, counters, registers, decoders and storage devices. Analog devices are studied as they relate to their applications in digital circuits. Emphasis will be placed upon systems application.

Prerequisites: Electricity for Electronics; concurrent enrollment in Math, Technical, Advanced

(628-110) Manufacturing Technology II

This is a study of computer-controlled manufacturing processes with an emphasis on computer numerically controlled equipment. Concepts involved in achieving quality and productivity gains will be emphasized. The student will gain an understanding of terminology commonly used in the industrial environment.

(628-112) Robotics

A firm foundation in industrial robotics will be established. The major electronics and mechanics of common robots will be studied. Robot types, typical applications and end-of-arm tooling will be presented. The programming of pick and place and servo robots will be included.

(628-114) Electrical Machines and Control

This course is a study of direct and alternating current motors, their operating characteristics, construction and mechanical switching techniques. Three-phase power will be introduced along with sensors and system support equipment such as conveyors, palletizers and machine loaders/unloaders.

Prerequisite: Digital and Analog Circuits

(628-116) Microprocessor Fundamentals

The theory and application of the microprocessor for control functions, software logic and processing data will be emphasized. Advanced digital principles related to microprocessor system architecture, programming, timing and interfacing will be presented.

Prerequisite: Digital and Analog Circuits

(628-120) Control Devices

The course will cover industrial control devices, their uses and interface. The control device as a communications and information-gathering device will be studied. The student will learn to program and interface control devices such as programmable controllers, robots, microcomputers and vision systems.

Prerequisite: Digital and Analog Circuits

(628-122) Servo Systems

The course will examine industrial servo control. Focus will be on velocity and position control. Devices such as resolvers, encoders, stepper motors and industrial drives will be studied.

Prerequisite: Digital and Analog Circuits

(628-126) Blueprint Reading/CAD

The course will be a combination of instruction concerning symbolization used on industrial blueprints and an introduction to computer-assisted design. CAD will be examined from the point of view of basic principles, use and application to computer-integrated manufacturing.

(628-128) Systems Integration

The student will interface various control and manufacturing devices with working manufacturing systems. The course will stress communication, optimization, operator information and system safety.

(628-130) Manufacturing Systems Application

The student will develop, in a group setting, a real or simulated manufacturing system which characterizes the concepts learned through the individual courses. The application for the study will be an existing manufacturing operation in an area industry.

Prerequisite: Systems Integration

(628-144) Electrical Power Systems

This course is intended to enable the student to work with industrial power distribution systems. Emphasis will be placed upon in-plant distribution of single- and three-phase systems as applied to automated manufacturing systems. Emphasis will be placed upon safe working practices related to high voltage systems.

Prerequisites: Direct Current and Alternate Current

(628-146) Motor Drive Systems

This course covers various drive systems. Included will be motor basics, direct current and alternate current. Students will understand variable frequency, pulse width modulation and six step. Direct current drives and their applications are included as they relate to systems integration.

Prerequisites: Direct Current and Alternate Current

Automated Manufacturing Systems Technician Careers



**Careers for the
Technically
Innovative**

A Short Letter To People Who Might Be Interested In Automated Manufacturing Systems As A Career...



You might ask yourself, "What exactly is automated manufacturing?" It is the integration and coordination of existing machines and equipment with modern solid-state devices, such as computers, programmable logic controllers and sensors, to form an intelligent manufacturing process.

With an associate degree in Automated Manufacturing Systems, you can choose from a wide range of career opportunities. This 72-week (two-year) program entails hard work that you will find fun and exciting.

After you read this brochure, talk with our counselor to gain further insight into a rewarding career as an Automated Manufacturing Systems Technician.

Sincerely,

Fran Winkler Dave Hoffman

Fran Winkler and Dave Hoffman
Instructors, AMST Program

Our Graduates Have Found Great Jobs. Here Are Some Examples...

PLC Programmer - Kinetic Systems, Menasha

Applications Engineer
Professional Control Corporation, Appleton

Field Service Technician
Giddings & Lewis, Fond du Lac

Sales Application Engineer - Square D, Oshkosh

Maintenance Technician
Pierce Manufacturing, Appleton

Electrical Designer - Weldmotion, Menasha

Maintenance Technician
Waupaca Foundry, Waupaca

If You Were Working As An Automated Manufacturing Systems Technician, What Could You Do?



Automated manufacturing deals with both concepts and hands-on applications. Because of this diversity, an abundance of opportunities awaits you. These opportunities will allow you to grow to any limits that you set. You could be involved in:



Programming Programmable Logic Controllers (PLC's) in ladder logic.



Interfacing manufacturing cells with sensors, computers and machines.



Implementing vision technology in a manufacturing environment.



Programming and interfacing robots or robotic-like machines.



Interfacing machines with other machines to update and automate.



Working at stations and concepts in SPC, CAD and CAM.

AUTOMATED MANUFACTURING SYSTEMS TECHNICIAN: The Associate Degree... What's In It For You?



A Quicker Route To Your First Job On Your Career Path.
Start in just two years, not four.

Work Classes Around Your Life And Schedule.
Go to school, days or nights.

THE PAYOFF: Getting The Job.
At FVTC, 93 percent of our graduates get jobs in their field. Automated Manufacturing Systems Technician graduates have proven their value in the job market. Salaries and opportunities are great!

You Can Work, Go To School And Still Live At Home. Or you can choose to live in our on-campus housing.

Our Teachers Have Been There.
At FVTC, our instructors have industrial experience in electricity, electronics, PLC's, Robotics and CAM systems.

You'll Get Real World, Hands-On Experience On Industrial Controls And Equipment.
Our graduates are ready to contribute from their first day on the job.

Here's What Some Of Our Graduates Have Said About The Program...

"The Automated Manufacturing Systems program prepared me very well for my employment. It opened up so many opportunities for me in finding a job. I could have gone for electronics, PLC's or computers. I ended up using all of these for my position. It was a very good program and I would recommend it to anyone."

"The Automated Manufacturing Systems program was an enjoyable, educational experience because of the degree of practical "hands-on" training on different industrial equipment. The variety of subjects that were covered continued to maintain my interest as the program progressed. Especially rewarding was the chance to combine all of the learned concepts into a working, moving manufacturing system."

ALUMINUM MANUFACTURING SYSTEMS TECHNICIAN

Technical Program: 2 Years
Graduation Requirement: 69 Credits

BLOCK 1	
628-102 Automated Systems, Introduction to	1 Credit
628-104 Electricity for Electronics	3 Credits
628-106 Manufacturing Technology I	2 Credits
801-130 Communication, Language	2 Credits
804-126 Math, Technical, Intermediate	3 Credits
	11 Credits

BLOCK 2	
605-147 Industrial Computer Programming	3 Credits
628-108 Digital and Analog Circuits	3 Credits
628-110 Manufacturing Technology II	2 Credits
804-127 Math, Technical, Advanced	3 Credits
	11 Credits

BLOCK 3	
419-102 Hydraulics	2 Credits
628-112 Robotics	2 Credits
628-114 Electrical Machines and Control	2 Credits
628-118 Microprocessor Fundamentals	2 Credits
628-146 Motor Drive Systems	2 Credits
Electives	2 Credits
	12 Credits

BLOCK 4	
628-120 Control Devices	3 Credits
628-122 Servo Systems	3 Credits
801-100 Communication, Basic Application	2 Credits
809 Economics, Basic	1 Credit
	11 Credits

BLOCK 5	
419-104 Pneumatics	2 Credits
628-126 Blueprint Reading/CAD	2 Credits
628-128 Systems Integration	4 Credits
801-101 Communication, Written Application	2 Credits
Electives	2 Credits
	12 Credits

BLOCK 6	
628-130 Manufacturing Systems Application	2 Credits
628-144 Electrical Power Systems	2 Credits
801-120 Communication, Technical	3 Credits
809-115 Psychology of Human Relations	3 Credits
Electives	2 Credits
	12 Credits

How To Get Started...

Call or write Noreen Johnson, our division counselor. Tell her about your current situation and what you're interested in. She can help.

Technical Division
Fox Valley Technical College
1825 N. Bluemound Drive—P.O. Box 2277
Appleton, WI 54913-2277
(414) 735-5775

Gateway Technical College

COMPUTER INTEGRATED MANUFACTURING TECHNICIAN

Associate of Applied Science Degree

Major courses (*) in this program are taught at Gateway Technical College-Racine Campus. (Selected courses may be taken at the Kenosha and Elkhorn Campuses. Contact a Gateway counselor for details.)

Computer Integrated Manufacturing Technician 10-628-2

★1989-90

Course Descriptions

Course Number	Course Title	Credits	Hrs Per Wk In Class Lab - Lab	Resident Course Fees
First Semester				
628-100	*Automated Mfg. Concepts/Intro OR	2	(2-0)	\$ 74.50
628-101	*Concepts of Enterprise/CIM for Mgmt.	(2)	((2-0))	(74.50)
804-151	*Math 151 (Prereq. 804-100 or satisfactory placement test score)	2	(2-0)	74.50
804-152	*Math 152	1	(1-0)	38.25
804-153	*Math 153 (Prereq. 804-151)	2	(2-0)	74.50
105-131	*Microcomputers/Intro to	3	(2-2)	110.75
606-108	*Technical Drawing/Understanding	3	(2-2)	114.75
809-103	*Sociology, Introductory	3	(3-0)	110.75
		16	18	\$598.00
Second Semester				
806-121	*Physics I (Prereq. 804-153)	3	(2-2)	117.75
606-126	*Computer Aided Drafting	2	(0-4)	76.50
804-161	*Math 161 (Prereq. 804-151)	2	(2-0)	74.50
804-162	*Math 162 (Prereq. 804-153)	2	(2-0)	74.50
801-101	*English Composition I (Prereq. 801-100 or satisfactory placement test score)	3	(3-0)	110.75
628-102	*Automated Manufacturing Programming (Prereq. 628-100 or 628-101)	3	(2-2)	117.75
628-103	*Manufacturing Processes - Machining & Welding	3	(2-2)	117.75
		18	23	\$689.50
Third Semester				
623-175	*Quality Control	3	(3-0)	110.75
628-104	*Computer Aided Design & Manufacturing (CAD/CAM)	3	(1-4)	117.75
809-150	*Psychology, Introductory	3	(3-0)	110.75
620-110	*Robotic Mechanisms I	3	(2-2)	117.75
	*Elective	3	(3-0)	110.75
		15	18	\$567.75
Fourth Semester				
628-105	*Computer Integrated Mfg. Applications	4	(2-4)	157.00
606-174	*Automated Mfg. Systems	3	(2-2)	114.75
810-101	*Speech/Fundamentals of	3	(3-0)	110.75
801-105	*Technical Writing (Prereq. 801-101)	3	(3-0)	110.75
	*Elective	3	(3-0)	110.75
		16	19	\$604.00
Suggested Electives				
605-122	Electronic/Principles (Prereq. 605-112)	2	(1-2)	78.50
605-174	Digital Circuits (Prereqs. 605-122 & 605-101)	3	(1-4)	117.75
605-112	AC/DC Principles (Prereq. Algebra)	3	(2-2)	117.75

Automated Manufacturing Concepts/ Introduction To

Overview of the application of computer-based automation. Presentations will focus on computer controlled modular subsystems for product design, part forming, assembly of parts, sub-assemblies, production planning, control, information, data control and how subsystems are interconnected and communication requirements to form an "integrated" system.

Automated Manufacturing Programming

A study of automated manufacturing equipment, set-up, operation and programming. Types of coding, feeds and speeds, tool selection and other applications are studied. The student will use microcomputer systems for program creation, editing and down-loading.

Automated Manufacturing Systems

Work on the practical applications of automated manufacturing systems and industrial processes. The course is a lab and lecture with emphasis on the practical integration of manufacturing, the mechanical design and computer electronics in control processes. Practical application of knowledge in plant layout, material flow, inventory control and data communication will also be covered.

Computer Aided Design & Manufacturing
Function and operation of CAD/CAM equipment to include: plotters, digitizers, printers, and modems. Overview of CAM application software packages for numerical control, circuit board design, flat pattern layout, and nesting are studied.

Computer Integrated Mfg. Applications
CIM techniques are to analyze and implement actual or simulated manufacturing applications. Student teams will select, plan, and develop a project proposal which will incorporate application and integration of CIM subsystems to manufacture or process a part or product. Application solutions will require gathering and developing of data, planning and scheduling a process, a quality and process control plan, hardware and software engineering, actual or simulated application, and a project report.

Computer Aided Drafting

Study of basic interactive computer graphics commands, used in the creation of lines, circles, arcs, fillets, etc. Also covers dimensioning commands, cartesian and polar coordinates, erase and zoom commands. All drawing is done on the computer.

NOTE: Prerequisites can be waived with department approval.

Requirements for Graduation:

1. 65 Credits with an average of 2.0 or above.
2. *Average of 2.0 ("C") or above for these major courses.
3. *Courses which may be taken prior to entry in the program.

* Note: Resident course fees are based on the 1989-90 tuition rate of \$35.25 per credit. The tuition increase for 1990-91 is yet to be determined.

From time to time the District may offer a particular course out of published sequence. By so doing, the District does not obligate itself to offer succeeding courses out of sequence.

Concepts of Enterprise / CIM for Management

Covers non-engineering and non-manufacturing functions of computer integrated systems. Introduces computer integrated manufacturing functions for management decision making, including elements such as supervision of communication systems, project management, technical reports and presentation of graphics.

Manufacturing Processes — Machining & Welding

Processes and principles related to industrial machining to include: milling, turning, grinding, drilling, boring, broaching, and NC machining. The use of fasteners, adhesives and welding applications are also studied through theory and "hands on" experience.

Microcomputers/Intro To

Beginning course emphasizing essential computer concepts and terminology with microcomputer laboratory activities including word processing, spreadsheet programs, database programs and an introduction to the BASIC programming language.

Quality Control

The concepts of quality; quality control administration; quality as an engineering function; application of statistical techniques, such as frequency distributions, control charts and sampling tables; quality control applied to new designs, studied. Actual or simulated industrial situations are presented.

Robotic Mechanisms I

Integration of electromechanical mechanisms and drive with industrial robot fundamentals. Study of servo drive systems of the electric, hydraulic and pneumatic type and how they relate to mechanical drive systems. Intro to generic robotology and their industrial applications.

Technical Drawing/Understanding

Surveys activities in the drafting departments, print rooms, and graphic arts areas of business and industry. Multiview, axonometric, oblique projections; lettering, dimensioning; auxiliary views, sections, revolutions. Copy methods — sketching, hectograph, diazo, photographic.

Entry Level Occupations - Major Occupations Available to Graduates of the A.D. Computer Integrated Manufacturing Program

1. **Computer Integrated Manufacturing Engineer/Technician:** Responsible for the integration of equipment involved in automated manufacturing operations.
2. **Manufacturing Engineering Technician:** Assists in the upgrading of all manufacturing areas related to computers, as part of overall manufacturing problem-solving.
3. **Robotic Specialist:** Programs and edits electromechanical devices as well as trains new employees in this area.
4. **Manufacturing Technician:** Utilizes special knowledge of computer numerical control (CNC) machine tools.

Advancement Opportunities

Advancement in the manufacturing of the future may be accomplished by further study which may lead to career opportunities such as:

1. **Manager - Computer Automated Manufacturing**
2. **Consultant - Automated Manufacturing**
3. **Director - Automated Applications**

Other Information

Aptitudes and Interests: Must be detail conscious, able to perform well in reading and math areas, and enjoy people contact. Interest in computers and electromechanical devices, and their application to the manufacturing process is necessary. Should be willing to learn new advances and apply past experiences.

Helpful High School Courses: Machine Shop, Drafting, and Microcomputer courses.

Placement Information: Not available at this time.

Sources of Additional Information: Gateway Library. Talk with Gateway Instructors and/or someone working in the field.

054 1/88 CLR

Lakeshore Technical College

Title: Technical Applications in the CIM Environment
Credits 12

Courses	Cr
Orientation to the Computer Integrated Enterprise	1
Business Applications Overview	1
Manufacturing Resource Planning (MRP)	2
CAD/CAM Linkages	2
Manufacturing Technologies	3
Implementation Migration	1
Integrated Systems Application	<u>2</u>
TOTAL	12

Course Descriptions

Orientation to the Computer Integrated Enterprise

The student will be presented with an overview of the computer integrated enterprise involving management, engineering and production. Emphasis will be placed upon the technologies involved, the benefits and the integration requirement.

Business Applications Overview

The course will provide the student with the opportunity to explore the integrated business enterprise. Emphasis will be placed upon financial applications and costing from order entry to financial analysis.

Manufacturing Resource Planning

The course will examine the application of the manufacturing resource planning role in the computer integrated enterprise. Various business and manufacturing applications such as purchasing, inventory, master scheduling, production control, etc. will be reviewed. Particular attention will be paid to the inter-relationships between the applications and specifically how they affect plant floor operations.

CAD/CAM Linkages

The course will provide the student with an understanding of the communication linkages from computer assisted design to computer assisted manufacturing to computer numerical control. Emphasis will be placed on the implementation of computers in the design of manufactured components (CAD), product engineering (CAE) and tool path creation for computer numeric control (CNC) machines.

Manufacturing Technologies

The course will introduce emerging technologies which are necessary to successfully implement computer integrated manufacturing. Examples of topics that will be covered are statistical process control, just in time, set-up reduction, group technology, etc. Applications of processes related to robotics, vision systems, and bar coding will be covered.

ISAC PROGRAM STRUCTURE

PHASE I -- Introduction to Integrated Systems Course: 699-100 (1 Credit/18 Hours)

1. General format of ISAC program.
2. CIM acronyms and terms.
3. Overview analysis of an integrated system.
4. Contrasting CIM technologies.
5. Role of team work and communications.
6. Introduction to the ISAC Integrated System.

PHASE II -- Components of an Integrated System (4 courses - 2 credits/36 hours each)

A. Computers and Systems Architecture Course: 699-102 (2 credits/36 hours)

1. Elements of a computer system.
2. Data base systems.
3. Levels of language.
4. Disk operating systems.
5. Flow charting.
6. Programming.
7. Files and data bases.
8. User software.
9. Telecommunications.

B. Manufacturing Planning and Control Course: 699-104 (2 credits/36 hours)

1. Bill of materials.
2. Inventory control.
3. Business planning.
4. Master schedule.
5. Material requirements planning.
6. Purchasing.
7. System evaluation.
8. Just-in-time.
9. CIM manufacturing planning and control.

C. Product Design and Product Analysis Course: 699-106 (2 credits/36 hours)

1. Dimensional metrology.
2. Statistical process control.
3. Computer aided design.
4. Simultaneous engineering.
5. Automated inspection.

D. Automated Production and Process Control
Course: 699-108 (2 credits/36 hours)

1. Process controllers and networking.
2. Programmable logic controllers.
3. Material handling systems.
4. Robotics.
5. Automatic identification.
6. (CAD/CAM) shared data bases.
7. Compact II programming.
8. Post processors.
9. Tool path simulation.
10. Down loading.
11. Tool requirements.
12. ~~Machine setup.~~

PHASE III -- Applications of an Integrated System
Course: 699-110 (3 credits/54 hours)

1. Team structuring
2. Product development
3. Simultaneous engineering
4. Team problem solving
5. Production simulation
6. Product production

Milwaukee Area Technical College

Abstract

Milwaukee Area Technical College's Computer Integrated Manufacturing Center

submitted by: John P. Stilp, P.E.
Associate Dean
Technical and Industrial

The Milwaukee Area Technical College's C.I.M. Development Center consists of a number of industrial automation devices, such as robotics, computer numerical control machine tools (CNC), programmable controllers (PLC), computer aided design and manufacturing (CAD/CAM) and coordinate measuring (CMM) which are integrated and working in conjunction with one another. In addition to the industrial equipment, a business computer links the Center allowing both the business and technical side of C.I.M. disciplines.

The Center is used to instruct the industrial workforce in the Southeastern Wisconsin area in the use of manufacturing automation, and to apply these techniques in their manufacturing plants. This facility, dedicated in 1986, is one of the first of its kind in the United States. It closely models the National Institute of Standards and Technologies' (NIST) Automated Manufacturing Research Facility (AMRF).

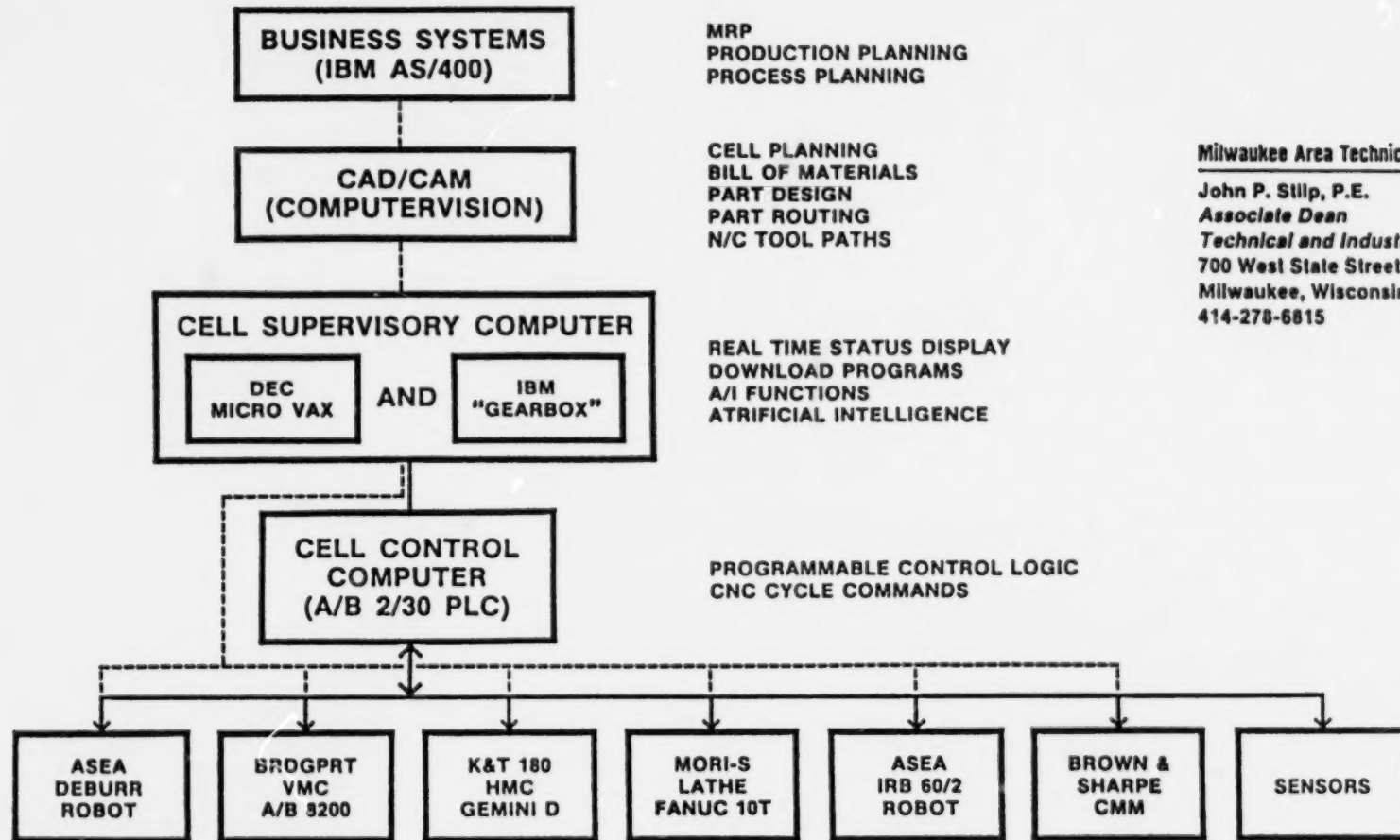
The entire operation is controlled by a series of computers, which coordinate all activities of each component in the cell, and relays messages back to a cell operator in the form of a graphic picture. All these activities are happening in real time under computer control. Artificial intelligence and specially developed algorithms are used to control certain processes. Each piece of industrial equipment is instructed to operate in the exact sequence as dictated by the manufacturing process plan which is developed as part of an overall material resource planning (MRP) system. The cell control computer receives information from the business and supervisory computers and automatically communicates to devices which are unattendingly manufacturing discrete piece parts. Production schedules are simulated using computer software to optimize cell production. Industrial computer controllers are all different vendors showing true flexible integration. Networking to these controllers takes place via point-to-point communications from the cell controller.

The components in the Center consist of the following:

- IBM AS/400 computer with MAPICS software for business applications
- CAD/CAM computer lab with Zenith-based AT and IBM-based PS series and RT computers and Autodesk's AutoCad, Computervision's Personal Designer/Machinist and Bridgeport's EZ-CAM software
- IBM industrial "GEARBOX" supervisory computer
- DEC VAX supervisory computer
- Allen Bradley PLC/230 cell controller
- Asea Brown Boveri pick and place robot
- Kearney & Trecker horizontal machining center with Gemini "D" controller
- Bridgeport vertical machining center with Allen Bradley 8200 controller
- Asea debur robot with vision system
- Brown & Sharpe process control robot (PCR) coordinate measuring machine
- Kennametal tooling, holders, inserts and tool breakage monitors
- Scientific Systems Incorporated custom software and integration
- IBM ELF data collection equipment
- Enerpac/Applied Power fixture power unit
- Honeywell Microswitch sensors located throughout the cell

The MATC CIM Development Center has developed unique partnerships with local and national industries listed above to promote manufacturing productivity to small and medium sized businesses.

FLEXIBLE MANUFACTURING CELL CONTROL HIERARCHY



Milwaukee Area Technical College

John P. Stilp, P.E.

Associate Dean

Technical and Industrial

700 West State Street

Milwaukee, Wisconsin 53233

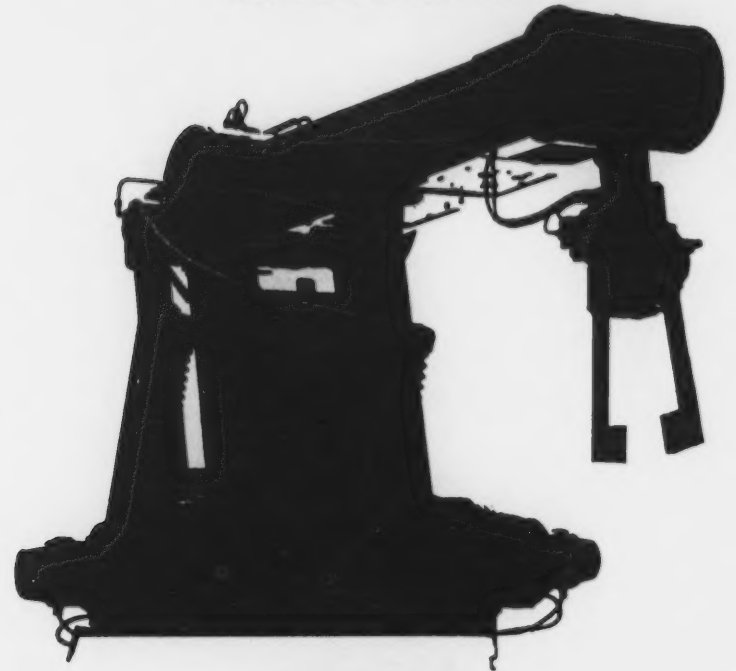
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COMMUNICATIONS:

PRIOR TO CELL OPERATION

DURING CELL OPERATION

CIM Development Center



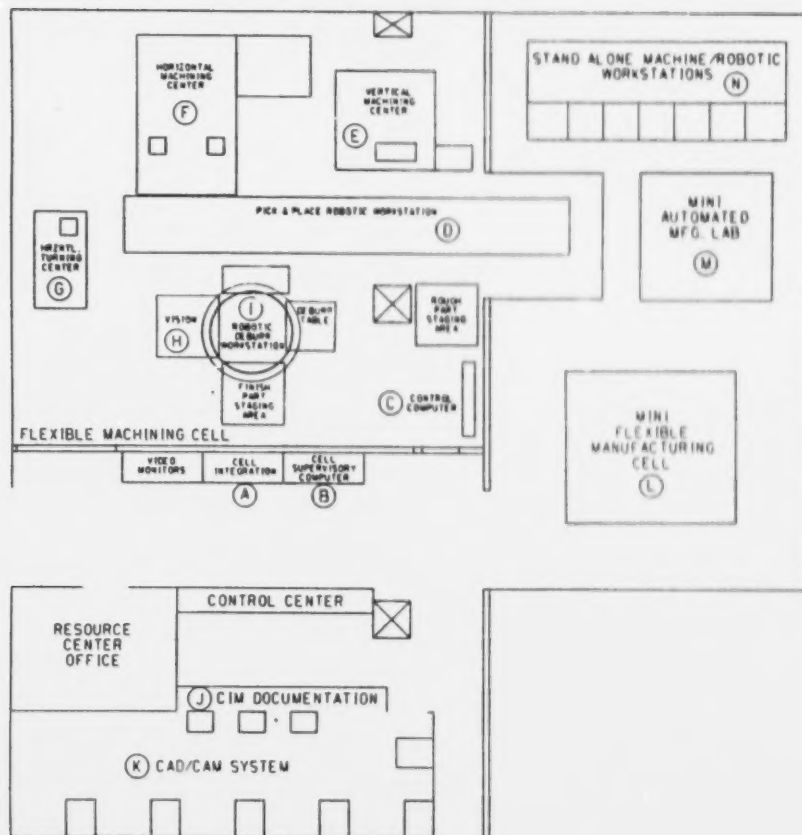
matc

MATC. The Institute of HIRE Learning!

Milwaukee Area Technical College

1015 North Sixth Street
Milwaukee, WI 53203

Milwaukee Area Technical College Computer Integrated Manufacturing Development Center



MATC CIM DEVELOPMENT CENTER

(A) Total Cell Integration:

REXNORD, INC., hardware and software allowing all cell components (machines and robots) to be run in an unattended working environment. All control logic, status, and communications software is menu-driven and programmed on the supervisory computer. A DECTALK voice synthesizer provides voice instructions and warnings to operator.

(B) Cell Supervisory Computer:

A DIGITAL EQUIPMENT CORP. Micro Vax computer containing customized REXNORD, INC. software to monitor real time status of the cell and communicate to each CNC controller and CAD/CAM system.

(C) Cell Control Computer:

An ALLEN-BRADLEY 230 programmable logic controller monitoring and controlling approximately 200 I/O points from all cell devices (sensors and machines) programmed by REXNORD.

(D) Pick & Place Robotic Workstation:

An ASEA robot with six-axis fully articulated movement mounted on a 40-foot track, positional accuracy of .004 and lift capacity of 130 pounds.

(E) Vertical Machining Center:

BRIDGEPORT milling center with ALLEN-BRADLEY 8200 control and 20-position automatic tool changer.

(F) Horizontal Machining Center:

A KEARNEY & TRECKER horizontal milling center featuring full three-axis KEARNEY & TRECKER control, a two-position shuttle table, and 30-position automatic tool changer.

(G) Horizontal Turning Center:

A 10-horsepower MORI-SEIKI lathe with a graphic "state-of-the-art" FANUC CNC control and an eight-position tool index.

(H) Vision Workstation:

An ASEA vision workstation is a gray scale image analysis system designed for industrial applications.

(I) Robotic Deburr Workstation:

An ASEA five-axis deburr robot equipped with a vision system for parts recognition and tools to "smooth" piece part edges prior to inspection.

(J) CIM Documentation Workstations:

Stand-alone terminals for creating CIM documentation using:

- A/I Artificial Intelligence
- simulation techniques
- CAPP - Computer Aided Process Planning
- G.T. - Group Technology
- Video equipment for feedback and instruction material

(K) CAD/CAM System:

A COMPUTERVISION 3-D CAD/CAM PC-based system capable of generating part designs and N/C tool parts downloaded into the flexible machining cell. Includes six workstations.

(L) Mini Flexible Manufacturing Cell:

A TECHNOVATE manufacturing and assembly flexible "mini" cell containing two IBM robots, two TERCO CNC tabletop mills, one HERCUS CNC tabletop lathe, all conveyors, and worktables integrated to manufacture and assemble a small robot product completely unattended.

(M) Mini Automated Manufacturing Lab:

PREP-based turnkey "mini" cell consisting of tabletop CNC lathe, mill, and robot for machining small plastic parts.

(N) Stand Alone Robotic/Workstations:

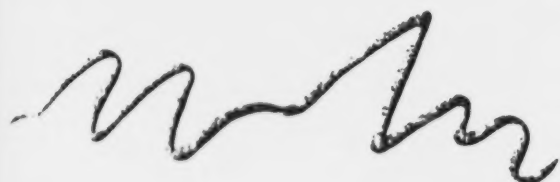
The AUTOMATED MANUFACTURING LAB is driven by a ZENITH-based PC computer.

Equipment includes the following for individual workstation development:

- Bridgeport Series I CNC mill
- GMF MOD Robot
- individual tabletop lathes and mills

What Is the CIM Development Center at MATC?

The CIM Development Center provides technical support services to orientate firms on advantages of Computer-Integrated Manufacturing (CIM) technology, provide MATC graduates as highly skilled CIM employees, retrain existing workers, try out CIM applications at MATC by co-sponsoring development projects, and afford access to resource materials including products developed by MATC.



CIM Orientation

MATC provides a weekly two-hour CIM orientation for managers, engineers, designers, and production employees or for special community groups. The session reviews the process of flexible manufacturing in the machining industry, CAD/CAM systems, and components of CIM, and is used to complete an individual CIM development plan. A free economic development service of MATC.

CIM Resource Materials

MATC has a library of CIM manuals, magazines, videotapes, and computer software available to assist in investigation or examination of CIM technology. MATC has also developed software packages and training materials available to industry and schools. MATC-developed CAD/CAM materials are already in use in over 700 schools nationwide.

TO OBTAIN INFORMATION ABOUT SERVICES CONTACT:

CIM Development	CIM Program Supervisor 278-6742
Continuing Education	Associate Dean, Continuing Education 278-0280
Admission to Programs	Admissions Counselor 278-6467



MATC. The Institute of HIRE Learning!

Milwaukee Area Technical College

700 West State Street
Milwaukee, WI 53233
414-278-6370

CIM Development Center



matc

Milwaukee Area Technical College

CIM Education

MATC provides industry with highly trained graduates of associate degree and vocational programs preparing for careers in CIM. The CIM Development Center provides training courses for several specialized technicians to support the CIM machining and durable goods manufacturing industry.

Some Associate Degree programs related to CIM include:

- **Automated Manufacturing Technology (Electromechanical Technology)**
Prepares technicians to install and maintain computerized systems.
- **Computerized Machining Technician**
Prepares technicians to operate computerized machines and to program the automated process.
- **Industrial Engineering Technology**
Prepares technicians to plan the process, including assembly, flow, cost, and quality control of products.
- **Welding Technology**
Prepares technicians to manage and program computerized welding systems.
- **Mechanical Design Technology**
Prepares mechanical CAD drafters and designers.
- **Electronic Design and Packaging**
Prepares electronic CAD drafters and designers.
- **Plastics Technology**
Prepares technicians to set up molding machines and supervise production of plastic products.
- **Fluid Power Technology**
Prepares technicians to manage, install, and maintain machines using hydraulics, pneumatics, and fluidics.

Some Vocational programs related to CIM include:

- **Tool and Die —**
Prepares tool and die skilled workers.
- **Machine Tool —**
Prepares operators of machining centers.
- **Computerized Numerical Control —**
Prepares programmers and operators of CNC machines.



CIM Industrial Retraining

MATC provides retraining service for industries faced with adding new technology and needing to upgrade workers. Employees may attend special courses, seminars, and workshops offered at MATC or at the employer site. Employees may attend a series of special courses and earn a specialist certificate in an advanced technology. Employees may need to have previous education and experiences evaluated to determine an individual career improvement plan.

Examples of technical courses offered in CIM programs:

- **Machining Techniques**
- **Technical Graphics**
- **Basic CNC Programming**
- **Industrial CNC Control 1**
- **Computer-Assisted Programming 1**
- **Inspection/Quality Control**
- **Industrial CNC Control 2**
- **Manufacturing Materials**
- **Computer-Assisted Programming 2**
- **Process Planning**
- **Tooling and Fixturing**
- **Computer-Integrated Manufacturing**
- **Materials Handling and Plant Layout**



CIM Industrial Application Development

MATC provides an economic development service to Business/Industry, individuals, and colleges in which the CIM Development Center is used to develop CIM applications, for testing the feasibility or cost effectiveness of the CIM process, or for testing new CIM cellular technology, and for planning future products or process requirements.

MACHINING ARTICULATION AGREEMENTS
MATC AND PARTICIPATING DISTRICT HIGH SCHOOLS
June, 1990

All programs listed award advanced standing in (628-101) Machining Techniques, a first semester course in MATC's Computerized Machining Technician associate degree program. The condition for all schools calls for the machining instructor's signature on a certified competency checklist. The design of this checklist varies from district to district (see sample agreement.) Technical mathematics articulation opportunities are also built into each agreement. At the moment, additional advanced standing opportunities tied to MATC's CNC Operator/Programmer diploma program are under discussion.

<u>High School</u>	<u>High School Course Titles Qualifying Students for Advanced Standing</u>
Cedarburg	Metals Manufacturing & Fabrication AND Vocational Metals AND Technical Drawing
Cudahy	Metals 5-6 OR Metals 3-4 with special projects
Grafton	Vocational Metals (plus prerequisites)
Greendale	Communication Systems and/or Engineering Drafting/Design AND Automated Manufacturing Systems (plus prerequisites)
Greenfield	Precision Machining (plus prerequisites) OR Vocational Metals (plus prerequisites)
Milwaukee Tech (MPS)	Machine Processes 3 (plus prerequisites) AND Blueprint Reading
Port Washington	Vocational Metals (plus prerequisites)
South Milwaukee	Machine Shop I AND Machine Shop II AND Machine Shop III
West Allis (Central & West Milwaukee)	Machine Shop Technology (plus prerequisites)

Moraine Park Technical College

Student Services

Admissions

Applications are accepted in the order received, provided the applicant meets minimum entrance requirements of the program. Each applicant must complete and forward an application, including a nonrefundable \$10 fee.

Counseling

Counselors, advisors, testing technicians, and career lab instructors are available to assist in career planning and program choice. All prospective students must meet with a Moraine Park counselor to insure that a sound career decision is made. Counseling is also available for other personal, academic, or vocational needs.

Financial Aid

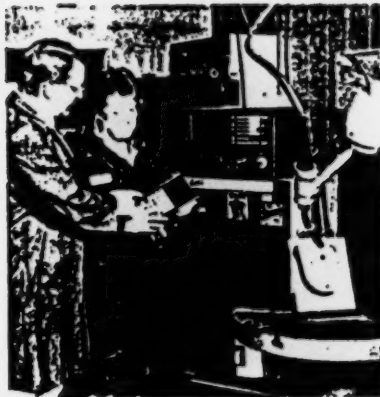
Financial aid is available to all eligible Moraine Park students, based on need. Interested students should complete the Wisconsin Financial Aid Form (WFAF) and submit to the appropriate Moraine Park campus. Students may also be eligible for Veterans' Benefits.

Other Services

Other student services at Moraine Park include placement assistance through the Job Placement Office; a variety of student activities, such as intramural sports, student government, and student clubs; housing assistance; health services; and much more.

For more information, contact the Student Services Department, Moraine Park Technical College at any of the three campus addresses listed on the back panel.

(People living outside of Fond du Lac may call toll free for program and related information: 1-800-472-4554.)

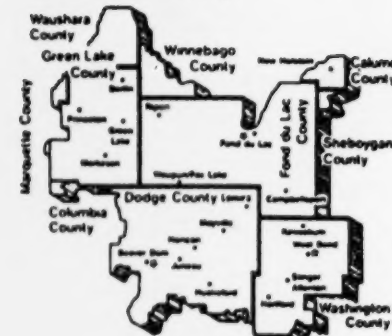


Robot welds via instructions from teach pendant.



CIM tools help technicians solve problems.

Moraine Park Technical College District Map



- Moraine Park Instructional Centers
- Moraine Park Campuses

Campus Addresses:

Beaver Dam Campus
700 Gould Street
Beaver Dam, WI 53916-1994
(414) 887-1101

Fond du Lac Campus
235 North National Avenue
P.O. Box 1940
Fond du Lac, WI 54936-1940
(414) 922-8611

West Bend Campus
2151 North Main Street
West Bend, WI 53095-1598
(414) 334-3413

5/89 - MCS10

An Equal Opportunity Employer/Educator
Functioning Under An Affirmative Action Plan.

Computer Integrated Manufacturing Technician



Two-Year Associate Degree
Offered at Fond du Lac

 **MORaine PARK**
TECHNICAL COLLEGE

Computer Integrated Manufacturing Technician

Two-Year Associate Degree
Offered at Fond du Lac

Program Description

The rapid expansion of automated and/or computer controlled machines and equipment in American industry has resulted in the integration of engineering and manufacturing functions. Technicians are becoming involved in set up, monitoring, planning, analyzing, controlling, and managing systems instead of performing repetitious assembly and materials handling tasks.

The Computer Integrated Manufacturing Technician Program provides instruction in integration concepts, engineering principles, and computer technology. Students develop skills in:

- Using computers and application software to access, interpret, and process data
- Product design
- Production planning
- Process and quality control
- Application, operation, and programming of CNC machines for fabrication/assembly
- Industrial robotics and computer controlled material handling equipment

Opportunities for Advancement

Graduates can advance to supervisory positions as department supervisor or foreman. Training, experience, and attitude will be keys to advancement in computer manufacturing.

Personal Qualifications

- Prior courses or work experience in machine shop and drafting
- Good reading and math skills
- Microcomputer experience helpful
- Human relations skills

RANGE OF OBTAINABLE MAJOR OCCUPATIONS FOR

COMPUTER INTEGRATED MANUFACTURING TECHNICIAN (CIM)

Possible occupations/employment for program graduates with additional work experience or education:

Senior Manufacturing Engineer

Senior CNC Programmer

Manufacturing Manager

Possible employment for program graduates: (entry level)

CAD/CAM Operator Technician

CAD/CAM Operator Technician: Prepares and processes work used daily in the manufacturing environment to support engineering and production.

CNC Programming

CNC Programming: Uses various tools necessary to prepare and program CNC equipment for production runs.

Robotics and Material Handling Technician

Robotics and Material Handling Technician: Works with programming of robots and programmable controllers used in various manufacturing environments.

Flexible Manufacturing Cell Manager

Flexible Manufacturing Cell Manager: Works with others to see that the overall success of the work cell is maintained, updated, and changed to meet the manufacturer's needs.

Production Planner

Production Planner: Works with others to establish, maintain, and adjust for the daily needs of the manufacturing environment.

Tool Processing Programmer

Tool Processing Programmer: Works with engineering in establishing required tooling for production of parts and detailing programs for maintaining tool quality.

Material and Inventory Controller

Material and Inventory Controller: Uses various methods — MRP, JIT — to maintain and control inventories to meet production forecasts.

Manufacturing Engineering Technician

Manufacturing Engineering Technician: A liaison position working in conjunction with engineering and manufacturing to implement product changes into the production flow.

Offered at Fond du Lac Two-Year Associate Degree

Course Number	Course Title	Credits
FIRST SEMESTER		
806-170	Basic Computer Aided Design and Drafting (CADD)	3
823-182	Manufacturing Processes - Machining (Jins Weeks)	2
823-183	Manufacturing Processes - Fabrication (Jins Weeks)	2
828-110	Computer Integrated Manufacturing Concepts	3
804-xxx	*Mathematics	5
801-110	Communication for Technicians	3

Total 18

SECOND SEMESTER

806-175	Computer Aided Design and Manufacturing (CAD/CAM)	3
823-122	Manufacturing Planning	3
823-142	Basic Numerical Control	3
828-125	Computer Technology	3
804-xxx	*Mathematics	4
801-183	Technical Report Writing	3

Total 19

THIRD SEMESTER

823-133	Robotics and Automated Material Handling	3
828-130	Computer Aided Manufacturing - Machining	3
828-123	Manufacturing Control	3
806-110	Economics	3
	Elective	3

Total 18

FOURTH SEMESTER

823-112	Computer Integrated Manufacturing Problems	3
828-140	Flexible Manufacturing Systems	3
828-138	Quality and Process Control	3
806-153	American Institutions	3
806-151	Psychology of Human Relations	3
	Elective	3

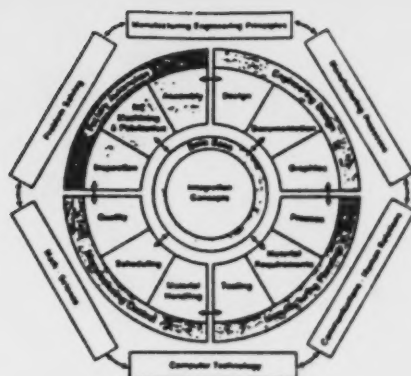
Total 18

Suggested Electives:

823-190	Metrology	3
804-155	*Mathematics - Unit 1	3
804-156	*Mathematics - Unit 2	3
804-157	*Mathematics - Unit 3	3

Course descriptions can be found in the Moraine Park Technical College Catalog.

**Moraine Park
Technical Institute**



Computer Integrated Manufacturing

Computer Integrated Manufacturing is a way to coordinate the many computerized subsystems of tomorrow's factory. This CIM Wheel, patterned after a model articulated by the Society of Manufacturing Engineers, illustrates the "integrative" or dynamic relationship between the different manufacturing functions. Utilizing a common data base powered by a central processing unit (CPU), the various departments of a manufacturing plant share information and trigger each other's response. For instance, a customer's order may generate production or may call for product redesign.

Moraine Park's two-year associate degree in Computer Integrated Manufacturing will provide a graduate with a broad background in the four main components of the manufacturing process: Engineering Design, Manufacturing Planning, Manufacturing Control, and Factory Automation. The CIM technician will also have a good understanding of the interrelated functions of the modern computerized manufacturing operation.

Computer Aided Design

Using interactive computer terminals and powerful applications software, engineers are utilizing new methods to design machine tools and parts. Drawings, geometry, and other data can be generated, stored, and then recalled for plotting, editing, or electronic transmission to other departments within the manufacturing setting.

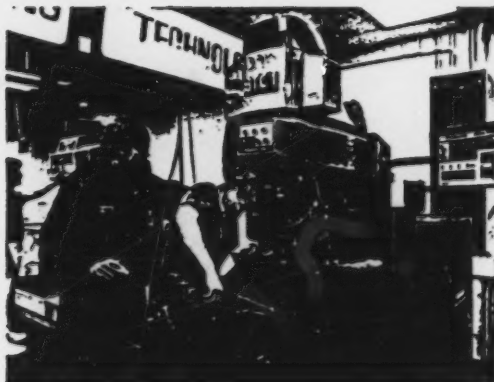
Based on drafting standards and principles of mechanical design, students in MPTI's CIM program will use a McAuto CAD/CAM system to create and interpret design data. A variety of microcomputers and applications software are also utilized to simulate manufacturing operations.



The Automated Factory

CIM brings together sophisticated computerized production technologies which already exist, such as Computer Numerical Control and Direct Numerical Control machining. The latest equipment will enable the technician to electronically feed design data from a stored file directly into a milling machine, lathe, or other form of fabrication and assembly equipment.

MPTI's CIM Technician students will learn how to utilize a variety of CNC and DNC equipment, industrial robots, and other machinery to form parts and fabricate finished products. The Bridgeport Machining Center shown here will automatically select and change 24 different tools. The CIM lab will also house a horizontal machining center with a 30-tool magazine and automatic pallet changer for flexible manufacturing.



Reply Card

Moraine Park's Computer Integrated Manufacturing Program is geared largely to the worker with existing skills in a manufacturing trade. Here is your chance to stay abreast of the changing technology. You may be eligible for advanced standing, based on your work experience. Come and meet with an MPTI counselor to evaluate your credentials. Enroll now, while there is still time.

- ☐ I'd like an interview.
- ☐ I would like my records reviewed for possible advanced standing.
- ☐ Please send me more information about CIM.

My other interests include:

- ☐ Electromechanical
- ☐ Computer Electronics
- ☐ Mechanical Design
- ☐ Industrial Engineering
- ☐ Engine Technology
- ☐ Structural Technology

Name Telephone

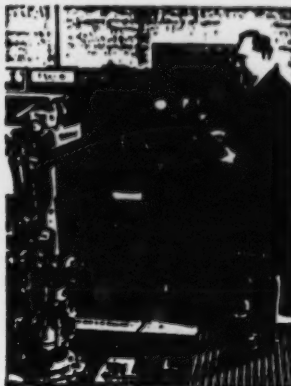
Address

Northcentral Technical College

125

In the future, industries will need to continually modernize to stay competitive in national and world markets. There is tremendous pressure to produce goods at less cost ... and with higher quality. The Automated Manufacturing Work Cell Lab at Northcentral Technical College can help industry with this awesome task.

TECHNOLOGY TRANSFER IS KEY GOAL



NTC's Automated Manufacturing Center is the culmination of five years of diligent planning by college staff, who also consulted with manufacturing personnel from a dozen area companies. As designed, the lab is useful for companies that need to retool their equipment and employees for the future.

While industry is a major beneficiary, NTC students and staff will also benefit from the

transfer of new and current technology the lab offers. Some half-dozen, full-time manufacturing based programs at NTC will use the lab as a kind of hands-on laboratory. Those programs include: Welding, Industrial Engineering Technician, Mechanical Design, Computer and Mechanical Drafting, Electromechanical and Laser Technology.

THE STRUCTURE FOR LEARNING

Delivery of the new technology is structured around a 12-credit advanced certificate in Automated Manufacturing Concepts. The curriculum focuses on the elements of automated manufacturing operations with the goal of helping our customers develop a working knowledge of what exists, how it works, and how it can be used. Individual one- or two-credit courses allow specialization outside the advanced certificate.

Workshops, seminars, and traditional classroom instruction provide the setting for learning in this exciting facility.

Programs can be specially packaged to suit the needs of individual companies.

CIM: THE HEART OF THE LAB



NTC's Automated Manufacturing Center is built around the concept of "CIM" or Computer Integrated Manufacturing being used increasingly in industry today. With CIM, manufacturing equipment is programmed by computer to perform specific tasks. In this lab, CIM is linked to three areas or "cells"

representing typical manufacturing operations - computer-controlled manufacturing methods, robotic welding/fabrication, and machining by computer numerical control. This flexibility is useful for companies that may want to use the lab to design new production configurations back at their own plants. Each piece of equipment in each cell can be used as an individual work station, or can be programmed to operate as a cell unit.

Here is a closer look at the major components of the Automated Manufacturing Center.

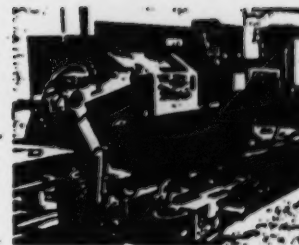
Computer Lab:

The lab allows operators to program manufacturing operations in any or all "cells." An operation designed on the computer can be sent directly to any piece of equipment, resulting in a "paperless drawing." Software here can program computerized numerical control, CAD/CAM, and statistical process control, among others.



Cell #1:

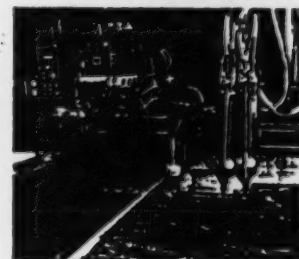
Amatrol CIM System
This cell is a complete turnkey system for teaching computer integrated manufacturing techniques. The cell consists of robot arms, a conveyor, a storage and retrieval system, CNC machines and other equipment.



Cell #2: Machining/Deburring

This cell includes four major industrial pieces of equipment for manufacturing: a vertical milling machine center, a turning center, a deburring station, and a robot mounted on a traverse track to serve these

pieces of equipment. The coordination of the various components is controlled through the use of a programmable logic controller (PLC).



Cell #3:

Welding/Fabrication
The welding/fabrication cell includes state-of-the-art robotic welding and CNC shape cutting equipment. The equipment has considerable flexibility for teaching fabrication techniques using automated methods, or for testing

process applications. The capability of using CAD/CAM with the shape cutter will also be available.

NTC AT YOUR SERVICE

The Automated Manufacturing Work Cell Lab is just one example of how NTC is helping area companies become more productive. We also offer customized training and technical assistance in a wide range of areas through our Applied Technology Center. The center provides a wealth of services and programs, including the popular Transformation of American Industry series. For information on all NTC services for business and industry, including the Automated Manufacturing Work Cell Lab, call Joe Hegge, Director of our Applied Technology Center, at 675-3331, extension 353.

NORTHCENTRAL TECHNICAL COLLEGE
WAUSAU, WI

ADVANCED CERTIFICATE PROGRAM
AUTOMATED MANUFACTURING CONCEPTS
FALL 1990

DESCRIPTION:

A twelve-credit associate degree level certificate in Automated Manufacturing Concepts is designed to upgrade persons employed in manufacturing related occupations in Central Wisconsin. A unique feature of the certificate curriculum is that it addresses key elements of automated manufacturing operations with the primary objective of helping the learner develop a working knowledge of what exists, how it works, and how it can be used. State-of-the-art equipment and software centrally located in a new manufacturing center is used as a learning environment for instruction.

Automated Manufacturing Systems

- Module: 1. Automated Manufacturing Overview - 1 credit
2. Concepts of Team Building - 1 credit
3. Using Personal Computers For Manufacturing - 1 credit

Technical Components

- Module: 4. Application of PLC's - 1 credit
5. Servo & Non-Servo Robotic Application - 1 credit
6. CAD/CAM/CNC Application - 1 credit

Quality/Workcell Technologies

- Module: 7. SPC Application - 1 credit
8. JIT Workcell Operations and Systems - 2 credits

System Applications

- Module: 9. Workcell Applications - 1 credit
10. Computer - Integrated Manufacturing/Business - 2 credits

University of Wisconsin-Stout

DEFINITION(S) OF CIM

*The total integration of all manufacturing elements through the use of computers

*The total integration of such individual concepts as CAD, CNC, robotics, and materials handling into one large system

-Source: SME

CIM Software Modules

*Business Planning and Support

*Product Design (CADD)

*Manufacturing Process Design and Planning (CAPP)

*Production Planning, Monitoring, and Control

*Manufacturing (CAM)

*Inventory Management (MRP)

*Inspection and Quality Control

OUR PRODUCT:

Our graduates are typically placed as manufacturing engineers, process engineers, industrial engineers, or production engineers.

OUR GOAL:

To produce a graduate capable of designing and building an automated manufacturing system (from "womb to tomb").

DESIRABLE ATTRIBUTES OF OUR GRADUATES

*Strong math and science background

*Attentive to "design for manufacturability"

*Understand materials properties

*Thorough knowledge of manufacturing processes

*Understand manufacturing systems, automation, and control systems

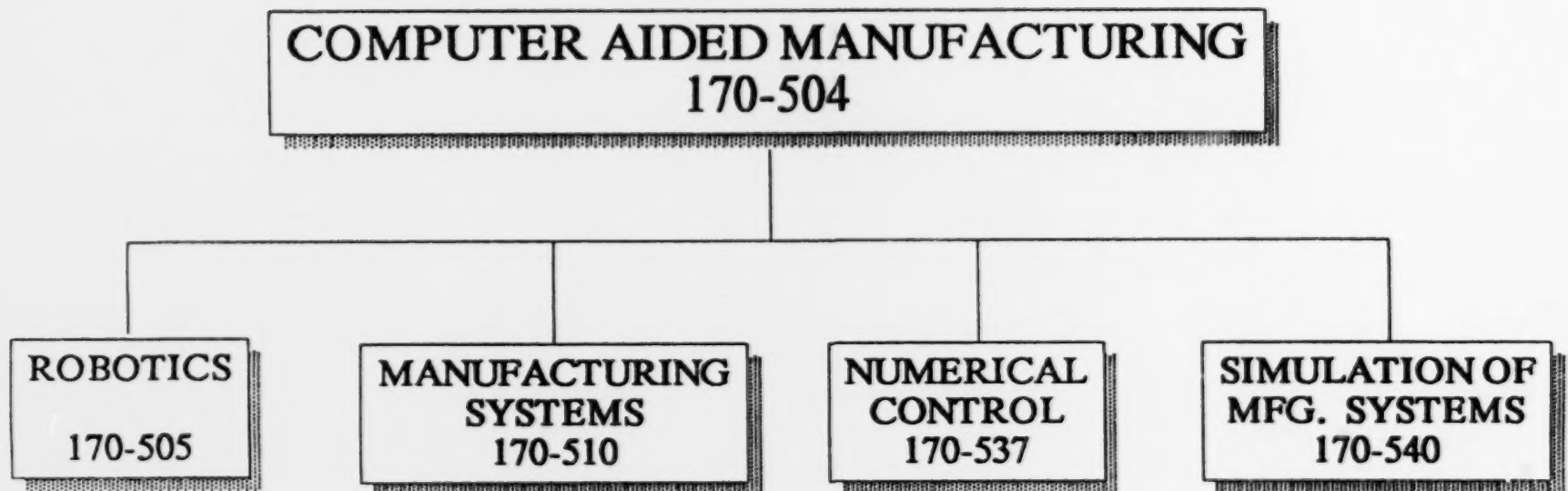
*Possess team skills

*Demonstrate interpersonal and communication skills

*Possess hands-on manufacturing experiences

*Able to work with other aspects of a business

PREREQUISITE STRUCTURE



170-504 COMPUTER ASSISTED MANUFACTURING

CREDITS:	3
CLASS TIME:	3 HRS/WK/SEM (Plus Arranged Lab Time)
PREREQUISITES:	354-141, or 354-144 or Instructor's Approval

- *INTRODUCTION TO TYPES OF MANUFACTURING SYSTEMS
- *INTRODUCTION TO PROGRAMMABLE AUTOMATION, INCLUDING NUMERICALLY CONTROLLED MACHINE TOOLS, ROBOTS, AND PROGRAMMABLE CONTROLLERS
- *INTRODUCTION TO GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING
- *INTRODUCTION TO MANUFACTURING SIMULATION
- *NC PROGRAMMING, COMPUTER AIDED PART PROGRAMMING (USING COMPACTII), AND USE OF PROGRAMMABLE CONTROLLERS

DESCRIPTION:

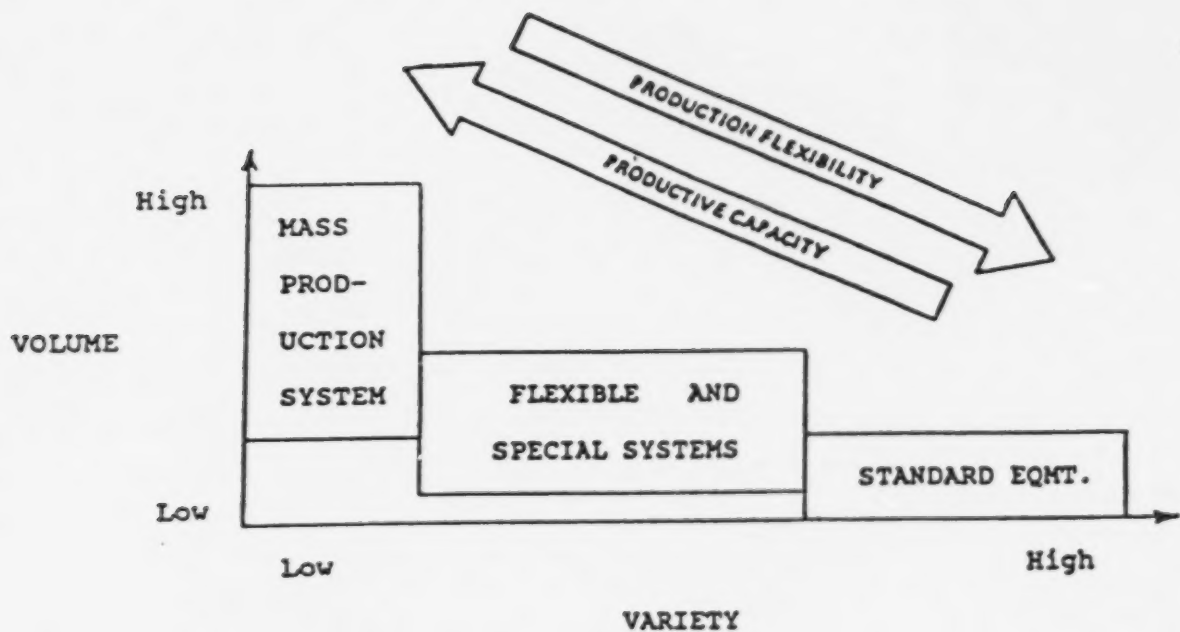
A lecture/laboratory course designed to introduce the student to the concept of group technology, computer scheduling, process control, coding and classification systems, and the relationship between part grouping and part costing. It includes justification for and application of computer assistance in the manufacturing process, machine process control, robotics and material handling, automated assembly, use of automated systems to provide real time inventory information, part grouping and product design in relation to the total manufacturing operation. Computer programming and part processing using the APPLICON BRAVO3 and COMPACTII integrated CAD/CAM system. Part shapes are drawn and analyzed on a Hewlett-Packard multi-color plotter. A simple materials-handling problem is presented using the PUMA 600 robot to gain exposure to robot application concepts. The course includes several individual and small group (2-3 people) activities.

APPLICATION:

The course provides exposure to fundamental concepts related to computer assisted manufacturing and acts as a prerequisite to 170-505 Robotics, 170-510 Manufacturing Systems, 170-537 Numerical Control, and 170-540 Design and Simulation of Manufacturing Systems. Enrollment typically includes, but is not limited to, Industrial Technology, Applied Technology, Applied Math, Technology Education, and Business Administration.

170-504 COMPUTER AIDED MANUFACTURING

- *Introduction to the types of product demand and types of manufacturing systems
- *Overview of CIM, CADD, and CAM
- *Introduction to programmable automation, including Numerically Controlled (NC) machines, robots, and programmable controllers
- *Introduction to Group Technology (GT) and Computer Aided Process Planning (CAPP)
- *Introduction to simulation of manufacturing systems
- *Integrated system architectures



TREND: Product mixes becoming more diversified

TREND: High volume production is decreasing, while mid-volume/mid-variety production is increasing

INTRODUCTION TO MANUFACTURING SYSTEMS

*Continuous or Mass Production Systems

*Intermittent Production (batch production)

*Low Volume Production ("job shop" production, tool and die shops, prototype work)

TREND: Continuous production decreasing, intermittent production increasing

TREND: Batch sizes decreasing to 1 (JIT)

INTRODUCTION TO PROGRAMMABLE AUTOMATION

*Numerical Control (NC)

- o Definition of an axis
- o Point to point vs continuous path control
- o Absolute vs incremental dimensioning
- o Floating vs fixed zero points
- o Manual NC programming using Word Address vs Tab Sequential formatting
- o Even vs odd parity
- o CNC, DNC and computer hierarchies

*Robotics

- o Robotic system components, levels of sophistication, applications
- o Servo vs non-servo robots
- o Robot designs/configurations
- o Intro to robot programming methods
- o Robot program storage

*Programmable Controllers

- o Introduction to input and output devices
- o Introduction to ladder logic programming

Computer Asisted Part Programming

- o NC programming languages (APT, COMPACT IIe, etc.)
- o Integrated CADD/CAM systems (BRAVO3 system, AUTOCAD, Bridgeport system)

WAYS TO CONTROL MANUFACTURING PROCESSES

*Mechanical control typically using cams, templates, and jigs) which lends itself well to high volume (mass) production

*Manual control (operator turns hand lever in turn driving a lead screw) which lends itself to intermittent or low-volume production (flexible)

*Programmable control (manual control of hand wheels replaced by precision servo or stepper motors). Includes NC, robots, and programmable controllers

TREND: Programmable automation rapidly becoming more popular for all types of production due to:

- *flexibility (changeover)
- *improved quality
- *multi-axes contouring

ARTICULATION: THE KEY TO
EDUCATIONAL TRANSITION FOR STUDENTS

Exploring Selected Alternatives

Submitted in Partial Fulfillment
of Requirements for

VoEd 8130
Critical Issues in Vocational Education

by
J. Timothy Mero

University of Minnesota

June 5, 1990

ARTICULATION: THE KEY TO EDUCATIONAL TRANSITION FOR STUDENTS

Exploring Selected Alternatives

Introduction

The renewed emphasis on traditional academics contained in *A Nation at Risk* and the emphasis on going to college have been viewed by many vocational educators at the secondary level as a de-emphasis of practical education curriculum.

Studies criticizing public education have created public demand for schools to strengthen their curricula in the basic skills. In response, educational policymakers in many areas of the country increased the number of academic credits necessary for high school graduation. During 1984, at least 44 states increased their graduation requirements for science, math, and English (Delaware Department of Public Instruction, 1985). The amount of time left for vocational education courses has thus been reduced, and a debate has risen over the amount and type of vocational courses needed. Those in favor of predominantly academic based education continue to argue that because many non-college bound, high school students may eventually attend college, a broad background in the basic skills is necessary. Groups opposed counter by stating that raising the number of academic courses required for high school graduation will deprive non-college bound students of the opportunity to explore occupational areas of interest or develop basic technical competencies in preparation for direct entry into the labor force.

The counter argument by those in favor of strong academic reform is to simply place all skill training at the postsecondary level. "This perspective has gained wider acceptance and is strongly emphasized by the postsecondary education community" (Erikson, 1989, p.21).

The educational system within the United States is not designed to allow students to complete their formal education at a single institution. Consequently, vocational students move from exploratory programs at the middle school or junior high school, to secondary/high schools, then to technical colleges and/or junior colleges, and/or four year colleges and universities. As a student moves through the system, they frequently encounter unnecessary duplication which is inefficient for the student and results in a loss of valuable time, effort, and motivation (Selman & Wilmoth, 1989).

The entire process of transitioning students from one level of education to another, or between one institution and another, Selman and Wilmoth (1989) define as articulation.

The recent interest in educational reform as well as the need to resolve articulation problems in vocational and technical education, according to Selman and Wilmoth (1989), has grown out of (a) declining enrollments and the resulting inherent survival response on the part of educators, (b) lean federal and state budgets, and (c) changing government.

Critical Issue

How does education transition students from secondary to postsecondary institutions?

What is Articulation

As used in the context of this paper, articulate as defined in the Merriam-Webster Unabridged Dictionary, means: to be united or connected in a systematic interrelation.

Articulation programs between secondary and postsecondary institutions are on the increase. Long, Warmbrod, Faddis, and Lerner (1986) describe this application of the term articulation as "a planned process linking two or more educational systems within a community to help students make a smooth transition from one level of institution to another without experiencing delays or loss of credit" (p.1).

In vocational education, articulation has been defined in a number of ways but the central theme is: "to eliminate as much as possible, unnecessary duplication of training across the levels" (Long et al., 1986, p.2).

Forging relationships with secondary schools while not new, has become an important priority for community, technical, and junior colleges across the nation. Technical preparation has begun to receive the attention of educators at both levels. The need to supply the nation's industries with trained technicians, coupled with the technical emphasis of so many two-year institutions, makes such liaisons increasingly popular. With the growth of increasingly sophisticated industrial technologies, however, comes the more difficult task of adequately preparing students for tomorrow's workplace. The task exceeds the time limitations of two-year colleges to develop properly trained technicians. The colleges can meet this challenge by establishing properly articulated programs with the high schools so that the students can assume their academic responsibilities sooner and acquire a complete set of marketable skills for their first job search.

General Education Track

According to Parnell (1985), three out of four high school students belong to a neglected majority of those who are not going on to earn baccalaureate degrees. Their potential and talents, according to Parnell, are often overlooked by educators who have focused their attention, as educational reformers, on students in the college preparation track while ignoring the sixty to seventy percent of high school students who will probably not earn a baccalaureate degree. The significant increase in the number of students placed in the unfocused general education track, dominate most high schools (Shapiro, 1986). Parnell (1985) referred to the general education track as the academic and vocational desert in the American education system. The curriculum of the general education track is often described as being made up of a combination of general, remedial, and personal/hobby courses.

Even though

their time in personal service and development courses such as physical education, arts and crafts, home economics, and work experience.

Shapiro (1986) sites a National Center for Educational Statistics studies in 1980, in which seniors evaluated various aspects of their high school experience. General education students rated their school experience as less satisfactory than did college preparatory or vocational track students, and were least satisfied with the quality of academic instruction and teacher interest in students.

Moreover, 63.5 percent of those who had dropped out of high school before being graduated indicated they were in the general education track at the time they left high school. Only 6.7 percent of the dropouts came from the academic track, while 29.8 percent came from the vocational program.

But vocational or career training on the high school level also leaves much to be desired. Says Parnell, 'Regardless of the research and despite our rhetoric about the uniqueness of each individual, many people still advocate that academic means advanced and is for the smart students and that career education is for the dumb students' (Shapiro, 1986, p.91).

In many high schools, vocational education programs are not viewed as the link to the next educational level. All too often, vocational education programs are viewed as having been reduced to "a euphemism for the handling of students with behavioral problems" (Shapiro, 1986, p.91). In this environmental setting, one cannot help but wonder how many of these difficult students behave the way they do because they see no purpose or future in their academic and vocational programs. Unable to visualize the relationship between their high school experiences and the knowledge, skills, and attitudes they will need to take on the challenges which lie ahead. From their perspective, high school could very well appear as the dead end road. Feeling that they are going nowhere, they become frustrated with an educational system which was never designed to allow students to complete their formal education at a single institution.

Articulation: The Missing Link

Articulation programs are known by various names. Warmbrod and Long (1986) suggest that the articulation programs between secondary and postsecondary institutions make high school students, embarked on vocational technical career programs which span grades 11 through 14, feel like they are college-bound as they catch views of new opportunities and a better, possible future. The future they see as attainable.

Not all articulation programs, however, are the same. Following a review of literature, it became apparent that the term articulation has been loosely applied to a broad range of programs. To add to the confusion, selected terms used to identify specific articulation programs have also been used as collective titles for groups of programs. The confusion arises when the titles used to group articulation programs, do not adequately describe all programs within the group. Each articulation program is unique and meets a specific educational need. Vocational educators should be familiar

with the more common term, used to identify articulation programs including: (1) barrier removal programs, (2) enrichment programs, (3) shared facilities, (4) combined enrollment, (5) contracted services, (6) transfer of credits, (7) time-shortened programs, (8) advance placement, (9) one-plus-one, (10) advanced skills programs, (11) core curriculum or pretechnology, and (12) vocational technical two-plus-two preparation.

Barrier Removal Programs

Not all so called articulation programs meet Long, Warmbrod, Faddis, and Lerner's definition, previously cited, "of helping students make a smooth transition from one level of institution to another" (Long et al., 1986, p.1). Articulation efforts which link two or more institutions to simply remove educational barriers and thereby benefit the student are not new. Manley (1970) defined a well articulated educational program as one that provides students the opportunities to develop to their highest potential in attaining educational as well as career objectives. The first four articulation programs meet Manley's definition by removing educational barriers.

Enrichment Programs

Enrichment programs are usually developed by a postsecondary institution in response from one or more local school districts. Lerner (1987) noted that a typical program might be provided to meet state requirement for gifted children.

The program arrangements are generally quite simple, and simply require the student to obtain a letter from the high school principal stating that their attendance at the postsecondary institution will not interfere with the students secondary school work.

In some cases, students can acquire dual high school and college credit, receiving their high school diploma in addition to earning, in some cases, two semesters' credit toward a college degree. The enrichment model is possible on a full-time or part-time basis and operates during the regular academic year as well as during summer terms. Credits can be held in escrow for later application toward a program at the school or, in some cases, may be transferred to other institutions of higher education (Lerner, 1987, p.17).

Although the typical enrichment program is oriented toward accelerated students in their senior year who plan to attend a postsecondary school after graduation, Lerner (1987) noted that programs can permit the participation of selected 10th and 11th graders. In addition to the regular postsecondary curriculum, programs could also include noncredit seminars, conferences, and workshops as summer enrichment activities.

Shared Facilities

Having two types of schools in close proximity has the advantage of sharing selected facilities. Lerner (1987) noted that this may be particularly true when the institutions involved are

required or would like to provide services or acquire expensive, sophisticated equipment and/or facilities that neither institution could provide on their own. With the possibility of scheduling problems, accepted as a given; shared facilities are cost effective, represent the best use of equipment, and can greatly enhance the recruitment efforts.

Shared facilities can cover an ever widening list of options from athletic facilities and dining facilities to library or even specialized classroom and laboratories.

One arrangement frequently made is the use of secondary school facilities by postsecondary institution for adult evening education programs of college level courses.

Combined Enrollments

Although not as obvious between secondary and postsecondary institutions, consider the advantage of having students from one or more high schools (public and/or private) enrolled in the same class. This is particularly beneficial when neither institution has a sufficient number of students to justify offering the course. Dual enrollment has a great deal of merit from an economic, and perhaps, an educational standpoint. Now consider the possibility of using postsecondary facilities. As Lerner (1987) observed, "This approach takes advantage of the best equipment available and makes possible the use of additional facilities" (p.16). As an alternative, consider the possibility of distant learning and the technological advancements which are available. The opportunities to combine enrollments quickly take on a different appearance. The magnet school concept is a variation of this program.

Contracted Services

Contractual agreements to offer classes at other institutions has a multitude of possibilities both horizontally as well as vertically. Again, the technological advancements in educational delivery systems provide a multitude of opportunities. The state of Wisconsin is divided into eleven Cooperative Educational Services Agencies (CESA) areas. Each CESA provides, among other things, contracted services which the individual secondary local educational agencies could not individually provide or justify. In specific instances, it may be desirable to have postsecondary institutions contract to provide certain advance courses taught in the high school. Lerner (1987) explains that "contracting represents an alternative source of instructional faculty and permits. . . students to obtain some exposure to other forms of higher education. In many cases, the institutions could not make the program available to students without contracting for these specialized services" (p.15).

A school could contract to offer special summer sessions for high school students in advanced classes in order for these selected students to take advantage of these special high-level classes. Through such an effort, the school not only enriches the curriculum, but students exposed to the school are more likely to attend that school in the future (Lerner, 1987, p.15).

Credit Transfer

Although few examples can be found of cooperative efforts between public secondary institutions and public postsecondary vocational technical institutions for direct transfer of credits, such agreements do exist between public secondary institutions and proprietary occupational institutions as well as community colleges which can serve as models.

The concept is quite simple and provides a link which helps a student make a smooth transition to the next level in the educational system. As Lerner (1987) notes, those students who complete a secondary vocational education program have acquired very specific skills and knowledge in preparation for employment. Some community colleges do grant some college credits for these achievements. The number of credits transferred will depend on the integration of the stated competencies into the postsecondary curriculum. Depending on the particular discipline in question, Lerner (1987) indicated that 3-18 hours of credit may be granted for the secondary school preparation. The awarding of advance credits generally follow one of two options.

1. Students who earn "A" grades in approved secondary courses receive the advance credit(s) directly.
2. Students who receive "B" grades in approved secondary courses, can gain advanced credits through the credit by examination procedure.
3. In addition, applicants for the transfer of credits must meet the college and program requirements and become matriculated students.

This process of transferring credits for authorized secondary courses differs from the advance placement (the next articulation program) in that the credits are accepted prior to commencement of the postsecondary course of study and awarded when the student matriculates. Spencerian College, for example, allows the transfer of 16 secondary credits (4 classes) for courses which include these:

English	Math
Typing	Shorthand - Gregg
Business Law	Business Correspondence
Secretarial Accounting	Accounting I
Human Relations	Filing and Records Management
Anatomy and Physiology	Medical Terminology
Salesmanship	Business Communication
Merchandise Math	Consumer Economics

(cited in Lerner, 1987, p.9)

If a student from a qualified high school earned "A" and "B" grades in approved courses and could transfer 16 credits, quarter or semester, into a Minnesota or Wisconsin state college/university, it would equate to approximately \$1,000 tuition. For private postsecondary institutions it could even be more. This is a recruiting tool technical colleges cannot currently touch. Lerner (1987) appropriately points out that:

Traditionally, 2-year postsecondary teachers have been reluctant to accept secondary learning experiences for college credit, yet these same teachers expect 4-year colleges to accept their students' accomplishments without question. Often, members of the faculty believe the students are not qualified and will not do well at the postsecondary level (p.8).

Often technical colleges create barriers for what may be reasonable consideration, only to lose more that they gain.

Time-Shortened Programs

Most of the articulation programs are designed to facilitate advance placement in postsecondary programs for those students who have mastered the fundamental competencies in high school. Time-shortened programs are designed to allow the student to complete postsecondary phase faster while saving the student the tuition equivalent to the time saved. As Long et al. (1986) noted however, "their skill levels do not advance beyond the traditional program" (p.4).

Advance Placement

Often referred to as time-shortened programs, the students are granted postsecondary credits for accomplishments at the secondary level. Although the credits are awarded in various ways, each has a caveat which distinguishes advance placement from credit transfer.

First, the person who entered the college as a secondary student, the enrichment program, and has aspirations for postsecondary study, are awarded advance placement. The enrichment program students in this case essentially study certain topics in depth rather than general technical training. As they matriculate they are awarded advance placement credits only if they enroll in the program for which their enrichment program applied.

Breuder and Martin (1985-86), identified a second type of advance placement in which college credits are awarded for high school courses completed. Long et al. (1986) noted that this second type involved college instructors and their high school counterparts reviewing the specific course syllabuses or task list. Upon agreement of which high school courses are more or less equivalent to introductory postsecondary courses, matriculating students can receive advance placement with the written recommendation of their high school instructors for those competencies mastered. "In the occasional cases where competencies for which credits has been awarded are shown not to be mastered, the student is given independent instruction in subsequent courses" (Breuder and Martin, 1985-86, p.35).

Hennepin Technical College in Minneapolis, Minnesota, serving both secondary and postsecondary students, has one of the most ambitious and successful advance placement programs as noted by Long et al. (1986).

Occupational curricula that are competency-based lend themselves readily to training any students--secondary, postsecondary, or adult--regardless of age. With this in mind, some articulation efforts respond to declining enrollments and

fiscal pressures by training high school and postsecondary students with the same curricula (and often together in the same classes). Some of these programs share faculty and equipment; others operate at independent facilities or institutions (Long et al., 1986, p.4).

The third advance placement program profile involves a skills test which allows the student to receive advance placement for demonstrated mastery.

The final profile for advance placement is noted by Lerner (1987). This profile involves individual students with "C" grades who applied for credit transfer in some postsecondary institutions will receive advance placement but will not receive the credit transfer until after successfully completing a specified number of postsecondary credits at the granting institution.

One-plus-One

A career ladder approach, the receiving postsecondary institution accepts students who have completed a one-year diploma (the first one in the one-plus-one) program at another institution. The most common would be a proprietary school. Although vocational technical diplomas are not awarded at the secondary level in Minnesota or Wisconsin, two scenarios come to mind. First, articulation programs must address the individual who moves into the state from another state in which the vocational technical diploma was awarded at the secondary level. Second, the individual in an advance placement program similar to the Hennepin Technical College program mentioned previously.

Advanced Skills Programs

Long et al. (1986) discusses advance skills and a common misnomer often applied to advance skills training.

Advanced skills programs also aim at avoiding duplication of training, but the purpose is not to speed students through the curricula more efficiently. Rather, advanced skills programs streamline fundamentals in order to make room in the curricula to teach more advanced skills than students would normally get in a traditional occupational program. Most of these programs have a high-technology emphasis, deliver more concentrated and more advanced content, and graduate students at a 'master technician' level. A misnomer that is often applied to all advanced skills programs (and many time-shortened programs as well) is '2+2,' even though many programs do not involve a structured learning sequence from grade 11 through grade 14 (Long et al., 1986, p.3).

For the purpose of this paper and to preclude the confusion associated with two-plus-two as a collective term, program titles identified by Long et al. (1986) for the two main advance skills programs, are adopted (a) core curriculum (or pretechnology) programs, and (b) "true vocational-technical '2+2' programs in which the entire occupational training curriculum begins in grade 11 and terminates at the end of grade 14" (p.5).

Secondary and postsecondary institutions, according to Van Allen (1988), are engaging in advance skill articulation programs

with increasing frequency. An advance skills program is an articulation program which joins the high school curriculum with two years of education at a postsecondary institution (Parnell, 1985). If properly designed, advance skills programs can provide maximum continuity of instruction within and between educational institutions. The end product is a highly specialized and employable, some may say trained as opposed to educated, technician. Warabrod and Long (1986) argue that the training possibilities for advance skills programming are only limited by educational resources and employment trends.

Given a favorable environment for their development, advance skills programs have unparalleled advantages. One significant advantage deals with separate educational jurisdiction joining together for the benefit of students. In the developmental phase, instead of focusing attention on institutional budgets, authority, boundaries, and prestige, Van Allen (1988) found that the participating educational institutions tended to focus on student outcomes which were defined in terms of student achievement levels based on employment opportunities. The student centered orientation provides the essential ingredients for the successful development and implementation of an articulation program. When the representatives of the participating educational institutions set aside vested interest for the expected gains in student achievement, with it comes the commitment, cooperation, and the effective communication essential for success.

Core Curriculum Program

The main purpose of core curriculum or "pre-tech" programs is to produce better prepared high school graduates for entry into postsecondary technical training programs. Core curriculum programs give secondary students a broad basic background in technology--a strong "core" of concepts and skills--but do not restrict students to making an occupational choice in their junior year. Many such programs include agreements that enable matriculating student to bypass postsecondary introductory courses and take more advanced courses than the 2-year training program would allow. Although the preparation is broader, high school students still receive sufficient specific skill training for entry-level employment (Long et al., 1986, p.3).

Several examples of an articulated core curriculum program are now available.

1. Oklahoma City's articulation effort, which is built on the Principles of Technology "tech-prep" curriculum developed by the Center for Occupational Research and Development (CORD) and the Agency for Instructional Technology. The articulation responds to community needs for more and better trained technicians for high-technology industries in the Oklahoma City area. It also is part of a local economic development effort to attract new high-tech industries to the city (Long et al., 1986, p.5).
2. One leader in this effort is Dan Hull, president of the Center for Occupational Research and Development (CORD) in Waco, Texas. CORD (1984) has developed a 2-year course in

applied science for junior and senior high school students that should improve their knowledge of science and math. Several secondary vocational schools throughout the nation have adopted this concept and are developing excellent course material for this 2-year sequence (Lerner, 1987, p.18).

3. The CORD (1985) Advance Technology Core Curriculum Guide is an articulation effort with four postsecondary tracks for (a) laser/electro optics, (b) instrument and control, (c) robotics and automated systems courses, and (d) micro electronics course.
4. Curriculum 2000, published by the Society of Manufacturing Engineers, is an articulation effort involving secondary and postsecondary two and four year colleges and articulated curriculum development for manufacturing engineer education and engineering technology.

Vocational Technical 2-plus-2 Program

The vocational technical 2-plus-2 program takes a total view which is focused on developing advanced skills for a high technology occupational area during grades 11 through 14.

Usually faculty members, administrators, and employer representatives are involved in planning the curriculum and deciding what will be taught at each grade level (Warabrod and Long, 1986, p.29). The curriculum arranges the study of mathematics, science, communication, technology, and specific technical skills associated with the occupational area under study to reach the master technician level of competencies by a step-by-step progression terminating at the end of grade 14. A career ladder approach is built in which permits student exit at the end of grades 12, 13, and 14 (Warabrod & Long, 1986; Long et al., 1986).

To achieve this ambitious outcome, vocational technical "2+2" programs must blend the resources of both the secondary and postsecondary institutions. This may involve creating a jointly operated training facility; writing new, comprehensive, competency-based curricula for all 4 years; building strong, close working relationships among participating administrators and faculty; sharing instructors; maintaining exceptionally close relationships with local employers; investing substantial planning time and funding; and creating and managing complex formal operational and funding structures (Long et al., 1986, p.6).

Horizontal Articulation

The time-shortened and advance skills articulation program are called vertical articulation which are designed to help the student view the multiple level educational system as a single system. Long et al. (1986) specifically identifies one other form of articulation which should be mentioned briefly.

Horizontal articulation facilitates the movement of a student from one campus or program to another of the same type. Currently this type of articulation effort is negotiated at the postsecondary level, but can impact directly on secondary/postsecondary

articulation efforts.

If the student participating in a vertical articulation program can now move horizontally at the end of the grade 11, the additional flexibility is a major selling point for initial entry of the vertical articulation program at the secondary level.

Overcoming Barriers

The most common concerns about articulation programs relate to staff acceptance, institutional turf concerns, poor internal communication and inadequate promotion (Long et al., 1986).

Following a review of literature, Stewart and Heiman (1986) concluded that:

While an increasing number of institutions were found to be working on articulation agreements, it appears that most reports described individual efforts rather than information about establishing articulation agreements. The common characteristic found in the reports related to the need to establish communication so that duplication of efforts could be minimized (p.115).

In their study of articulation in vocational agriculture, Stewart and Heiman (1986) substantiated that even though secondary and postsecondary vocational programs (agriculture) teachers have many mutual perceptions in common, more communication should occur. Stewart and Heiman recommend that secondary teachers involved in articulation programs should (a) learn more about postsecondary education, (b) visit postsecondary programs, (c) teach secondary students about careers requiring postsecondary preparation, and (d) refer prospective postsecondary students to the appropriate institutions. They also recommend that postsecondary teachers enhance the articulation effort by promoting communication with secondary teachers. Activities recommended by Stewart and Heiman for postsecondary educators to promote articulation include (a) appointing secondary teachers to program advisory committees, (b) visiting individually with secondary teachers at their institution, (c) inviting secondary teachers to visit postsecondary programs, and (d) developing a policy for awarding college credit for documented prior learning.

Implementing Interinstitutional Articulation

In a study of secondary-postsecondary articulation conducted for the National Center for Research in Vocational Education, Long et al. (1986) determined the approaches to articulation and identified common activities as well as barriers to the process. They identified two of the general models for articulation programs, the time shortened and the advance skill, mentioned previously. Regardless of the model followed, the articulation programs studied had the following characteristics in common: (a) leadership and commitment must be provided from the top, (b) faculty (secondary and postsecondary teachers) must be involved early, (c) relationships must be based on mutual respect and trust, (d) the mutual benefit to all partners must be ensured, (e) articulation agreements must be in writing, (f) communication between participants must be open, clear, and frequent, (g) initial goals must be modest, (h) responsibilities

must be clearly defined, (i) curricula must be competency-based, (j) the focus must be on mutual goals rather than individual/institutional interests (turf) (Long et al., 1986; cited in Lerner, 1987; cited Warmbrod & Long, 1986).

Lerner (1987) identifies the following twelve steps for consideration in implementing an articulation program:

1. Identify the need for and benefits of articulating with other educational institutions in your area.
2. Identify other educational institutions that would benefit from articulating with your school or college.
3. Meet with the chief executive officers (CEOs) of these organizations.
4. Assign someone the responsibility of directing the articulation effort.
5. Identify the person in the private occupational school who can certify transfer students from vocational school programs.
6. Establish clear communication channels within your institution and between and among institutions.
7. Determine the college or university degree program into which the private occupational school students can transfer.
8. Establish whether the transfer will be granted on a course-by-course basis or on the blanket concept.
9. Develop written articulation agreements for execution at the institutional level and between program departments.
10. Begin by selecting one or two program areas that appear amenable, where faculty members have established relationships, and that have a particular need for articulation. Once these program areas are successfully articulated and the benefits made visible, use these successes to get other occupational departments involved.
11. Establish a contact person or department at each school involved in the agreement.
12. Provide secretarial support for articulation coordinator and faculty to aid their coordination, planning, and curricula development.
13. Establish a system for certifying student competencies or educational accomplishments from the articulated courses.
14. Publicize the articulation arrangements and programs to students, parents, employers, and community officials (pp.18-19).

Summary

Successful articulation programs are focused on improved communication among persons at the secondary and postsecondary levels, and those policies and practices which facilitate student progress. Because of their close relationship to students on both levels, teachers are key personnel in a process. Improved articulation is a cooperative effort which must involve counselor and administrators at both levels. The success and extent to which any articulation program is negotiated involves credit or recognition for prior experiences at the secondary level.

Parnell (1985) offers seven specific recommendations for

developing cooperative efforts.

1. All students need a student centered curriculum. The barriers to achieving excellence for all students must be identified and removed.
2. Unfocused learning will not produce excellence. Educational programs must provide the necessary structure and substance.
3. Students must be able to view the educational system as providing a single, coherent program.
4. Students must see and feel a connectedness between what they do and the larger whole between education and the rest of the real world.
5. Students must experience or be able to envision a continuity in learning between one institution and another.
6. Secondary level vocational education curriculum must aim at preparing students for broad career areas rather than for specific jobs.
7. Students must see the value in and necessity to develop the competencies for continuing their learning throughout a lifetime as a means of avoiding obsolescence (cited in Shapiro, 1986).

There is no single articulation program which will satisfy all situations. Open, student focused communication is the key to successful articulation. If articulation programs are not developed between secondary and postsecondary institutions, every one loses. Vocational education programs at the secondary level may be placed at risk and the postsecondary program fail to develop the necessary feeder programs at the secondary level. Ultimately the students themselves have the most to lose. Articulation programs appear to be the key to success. By making postsecondary training programs meaningful, attainable, and more attractive to students, articulation can help keep future technicians from seeking their initial postsecondary training--and employment--outside the local area.

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ATTACHMENT F

Handouts from Frank Zenobia

ZENOBIA & ASSOCIATES

ADVANCED TECHNOLOGY GROUP (ATG)

WORLD CLASS MANUFACTURING				
MP&CS	OIP	CIM	SBP	OA/TC/MIS
Manufacturing Planning & Control Systems	Operational Improvement Processes	Computer Integrated Manufacturing	Strategic Business Planning	Office Automation Telecommunications

- MRP II
- Just-In-Time (JIT)
- Total Quality Control (TQC)
- Synchronized Mfg Optimized Prod. Tech (OPT)
- Distribution/Requirements
- Logistics Planning
- Procurement/Supply Line Mgmt
- Preventative Maintenance
- Optimization & Simulation
- Decision Support Systems
- Order Entry
- Financial Sys./Integrated to MRP II
- Forecasting Modeling

- AS/RS AGV
- Material Handling Flow Conventional-Automated
- Work Cell Flow & Control Concepts
- Factory Automation
- *Facility Layout & Flow
- *Re-Industrialization Program Management
- *New Plant Design
- *Facilities Management
- *Consolidations & Rearrangements
- *Conventional Cost Reduction Programs

- CAD Computer Aided Design
- CAM Computer Aided Manufacturing
- GT Group Technology
- CAPP Computer Aided Process Planning
- FOF Factory of the Future
- CIM-MRP II-JIT Integration

- Strategic Planning & Consulting
- *Strategic Business Planning
- *Strategic Manufacturing Planning
- *Human Resource & Organization Planning

- Office Automation
- Telecommunications
- MIS Planning
- *Software
- *Hardware
- *Communications

11040 W. Bluemound Rd., Suite 214, Milwaukee, WI 53226 (414) 475-7771

ATTACHMENT G

Group Assignments and Discussion Questions

SMALL GROUP WORKSHEET - MORNING SESSION

Group Participants:

Group Leader:

1. CIM Components

2. CIM Competencies

(over)

3. What articulation linkages are needed:

A. With other schools/districts

B. Business and Industry

Marv Franson , Group Leader #1

Virgil Noordyk
Gene Koshak
Terry Tower
Larry Haller
David Stinnett
Ken Mills

Merlin Gentz, Group Leader #2

Jon Stevenson
Jim Tucker
Ed Falck
Chuck Oestreich
Walt Peters
Mark Durkee

Ed Falck, Group Leader #3

Levin Lipsky
Robert Housner
John Ross
Steven Skowronski
Al Hiles
Bill Bulloch

Fred Skeebe, Group Leader #4

David North
Gordon Haag
Marcel Mildbrandt
Al Miller
Dennis Leonard

Gary Leonard, Group Leader #5

Mike W. Bird
Steve Prah
Dave Peterson
Al Pitts
Robert Zuleger
Ray Price

CIM Conference
June 6-7, 1990

SMALL GROUP WORKSHEET - AFTERNOON SESSION

Group Participants:

Group Leader:

1. CIM Mission/Position Statement

2. Curriculum Needs

(over)

3. Future direction of CIM for Wisconsin

John Ross, Group Leader #1

Gene Koshak
Jon Stevenson
Mark Durkee
Fred Skeebe
Dennis Leonard
Robert Zuleger

Al Pitts, Group Leader #2

Terry Tower
Jim Tucker
Robert Housner
David North
Gary Leonard
Ray Price

Ken Mills, Group Leader #3

Larry Haller
Ed Falck
Steven Skowronski
Gordon Haag
Mike W. Bird

Merlin Gentz, Group Leader #4

David Stinnett
Chuck Oestreich
Al Hiles
Marcel Mildbrandt
Steve Prah

Virgil Noordyk, Group Leader #5

Walt Peters
Kevin Lipsky
Bill Bulloch
Al Miller
Dave Peterson

ATTACHMENT H
*Certificate of Completion
&
Evaluation Form*

CIM Conference

Certificate of Completion

This is to certify that

Cim Participant

Participated in the CIM Conference at UW-Stout, on June 6-7, 1990

Bruce Siebold, Dean, School of Industry & Technology

Howard Lee, Project Director



A project sponsored by the Wisconsin State Board of Vocational, Technical and Adult Education and the
University of Wisconsin-Stout, Center for Vocational, Technical and Adult Education

**CIM Conference
June 6-7, 1990**

Evaluation Form

Directions: Please respond to the following items based on your experience in this workshop.
Use the following responses.

- 1 = P = Poor
- 2 = BA = Below Average
- 3 = A = Average
- 4 = AA = Above Average
- 5 = E = Excellent

Presentations/Sessions/Resources	Evaluation				
	P	BA	A	AA	E
	1	2	3	4	5
1. CIM - An Industrial Application - Don Manor.....	1	2	3	4	5
2. Technical College Presentation					
Chippewa Valley	1	2	3	4	5
Fox Valley Technical College	1	2	3	4	5
Gateway Technical College	1	2	3	4	5
Lakeshore Technical College.....	1	2	3	4	5
Milwaukee Area Technical College.....	1	2	3	4	5
Northcentral Technical College	1	2	3	4	5
Western Wisconsin Technical College.....	1	2	3	4	5
3. CIM at Stout - Bob Meyer.....	1	2	3	4	5
4. Future of CIM - Frank Cenovia	1	2	3	4	5
5. Small Group Discussion					
A. CIM competencies, components & articulation	1	2	3	4	5
B. CIM mission, curriculum needs & future of CIM	1	2	3	4	5
C. Small group presentation.....	1	2	3	4	5

6. What did you like best about the workshop?

7. What could be improved?

Center for Vocational Technical and Adult Education

Group numbers based on the PRIMARY group for this analysis

Analysis on 22-Jun-90 at 01:05 PM. Data from file: CIM90

Survey analysis of response to 13 questions, by 30 people

Question: 1

Cim - An Industrial Application - Don Manor

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	4.07	4.69	2.47	0.62	30	30	4.53	4.85	5.18	0.65
Omit	1	2	3	4	5					
0.13	0.00	0.00	0.07	0.13	0.67	People				
4	0	0	2	4	20					

Question: 2

Technical College Presentation - Chippewa Valley Technical College

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	3.77	4.04	1.65	0.74	30	30	3.50	4.04	4.63	1.13
Omit	1	2	3	4	5					
0.07	0.00	0.00	0.23	0.43	0.27	People				
2	0	0	7	13	8					

Question: 3

Technical College Presentation - Fox Valley Technical College

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	4.40	4.71	1.78	0.46	30	30	4.38	4.80	5.15	0.78
Omit	1	2	3	4	5					
0.07	0.00	0.00	0.00	0.27	0.67	People				
2	0	0	0	8	20					

Center for Vocational Technical and Adult Education

Group numbers based on the PRIMARY group for this analysis

Analysis on 22-Jun-90 at 01:05 PM. Data from file: CIM90

Survey analysis of response to 13 questions, by 30 people

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Question: 4

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Technical College Presentation - Gateway Technical College

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	3.60	3.72	1.36	0.96	30	30	2.94	3.57	4.59	1.66
Omit	1	2	3	4	5					
0.03	0.00	0.07	0.40	0.23	0.27	People				
1	0	2	12	7	8					

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Question: 5

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Technical College Presentation - Lakeshore Technical College

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	3.73	4.00	1.65	0.77	30	30	3.38	4.00	4.63	1.25
Omit	1	2	3	4	5					
0.07	0.00	0.00	0.27	0.40	0.27	People				
2	0	0	8	12	8					

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Question: 6

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Technical College Presentation - Milwaukee Area Technical College

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	4.17	4.31	1.30	0.66	30	30	3.80	4.32	4.90	1.09
Omit	1	2	3	4	5					
0.03	0.00	0.00	0.10	0.47	0.40	People				
1	0	0	3	14	12					

Center for Vocational Technical and Adult Education

Group numbers based on the PRIMARY group for this analysis

Analysis on 22-Jun-90 at 01:05 PM. Data from file: CIM90

Survey analysis of response to 13 questions, by 30 people

Question: 7

Technical College Presentation - Northcentral Technical College

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	4.13	4.28	1.26	0.59	30	30	3.81	4.24	4.78	0.97

Omit	1	2	3	4	5	
0.03	0.00	0.00	0.07	0.57	0.33	People
1	0	0	2	17	10	

Question: 8

Technical College Presentation - Western Technical College

DID NOT PRESENT

NOTICE: Item responses consist of 100% OMITs
No data will be printed.

Question: 9

CIM at Stout - Bob Meyer

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	3.70	3.96	1.67	0.84	30	30	3.36	4.00	4.63	1.27

Omit	1	2	3	4	5	
0.07	0.00	0.03	0.23	0.40	0.27	People
2	0	1	7	12	8	

Question: 10

Future of CIM - Frank Zenobia

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	4.57	4.57	0.57	0.57	30	30	4.09	4.67	5.08	0.99

Omit	1	2	3	4	5	
0.00	0.00	0.00	0.03	0.37	0.60	People
0	0	0	1	11	18	

Question: 11

Small Group Discussion - CIM competencies, components & articulation

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	4.13	4.28	1.32	0.70	30	30	3.75	4.31	4.90	1.15
Omit	1	2	3	4	5					
	0.03	0.00	0.00	0.13	0.43	0.40	People			
	1	0	0	4	13	12				

Question: 12

Small Group Discussion - CIM mission, curriculum needs & future of CIM

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	4.37	4.37	0.61	0.61	30	30	3.87	4.37	4.92	1.06
Omit	1	2	3	4	5					
	0.00	0.00	0.00	0.07	0.50	0.43	People			
	0	0	0	2	15	13				

Question: 13

Small Group Discussion - Small group presentation

(1)=Poor, (2)=Below Average, (3)=Average, (4)=Above Average, (5)=Excellent

Group	Mean		Stand Dev		Number		Quartile			
	Omit	No Omit	Omit	No Omit	People	Checks	First	Median	Third	IQR
0	4.20	4.34	1.29	0.61	30	30	3.85	4.33	4.90	1.05
Omit	1	2	3	4	5					
	0.03	0.00	0.00	0.07	0.50	0.40	People			
	1	0	0	2	15	12				

**CIM Conference
June 6-7, 1990
Evaluation Results**

6. What did you like best about the workshop?

- The opportunity for administrators and instructors from DPI, VTAE and the University to discuss CIM.
- Depth of discussion.
- Sharing of information and insight into other districts and schools.
- Discussion level.
- Good exchange with secondary.
- Too much to mention.
- Common interest and direction of programs.
- The fact that secondary schools were included.
- Sharing, networking.
- The ability to interact with technical school instructors.
- Bob Meyer and Frank Zenobia
- Open communication, good exchange of information, excellent spirit among participants, good management and planning. Kudo's to Howard Lee, Tim Mero, Orville Nelson.
- Small groups.
- Quality of presentations, networking with other schools.
- Getting together.
- The culmination of a statewide initiative was the highlight-we now will be able to move ahead.
- I believe something significant will be a result of the conference. Good job!
- Sharing.
- Seeing what is happening in other districts and in the industry today. The small group discussions were also great!
- Group interaction, small group discussions.
- Helping the VTAE to get together and give direction to CIM.
- Interaction and sharing of experiences, etc., by all members of the conference.
- Bringing in resources like Don Manor and Frank Zenobia.
- All three levels meet together.
- Everyone on all levels had input. I liked this. Also we had direction and I feel some committees will be developed and some progress will be made for all tech. ed. programs in CIM.
- Just to have the opportunity to be involved was most worthwhile. Good start on communications.
- Technical college presentations gave a good picture of CIM. Small groups with secondary and postsecondary were very good.
- This was a very worthwhile workshop! Good organization and excellent food and accommodations.
- Very good workshop. Thanks!

Evaluation Results Continued

7. What could be improved?

- Continue the effort.
- Articulation and sharing of information between secondary schools and tech schools.
- Continue this service.
- What needs to be done to successfully integrate this.
- Better pictures on the Stout presentation.
- Day was too long.
- Better room
- Include business leaders in future meetings to get their guidance/approval on what we are doing.
- Need follow-up to implement recommendations.
- I think a "study group" meeting, at the "buck," (informal get-together), could do more to break down the barriers and create friendships, than some meetings could. I would suggest it be done at the end of the first day.
- Probably the best individual objective conference attended - information - education and direction.
- Continue the good work. I am pleased I was here and feel it was very worthwhile.
- It was all very good.
- If possible, more time for presenters, such as Frank and Don.
- Some of the reports could be a little shorter, especially the first day, because of the long drive.
- Communications to share, "do not redevelop the wheel." Involve other schools, DPI. Expand DPI/VTAE articulation projects.
- It was embarrassing to see the UW-Stout person have poor transparencies and slides in backwards!